

# The Robinson Collection of Malaysian Mammals

by

J. E. HILL

Department of Zoology,  
British Museum (Natural History).  
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THE LATE H. C. ROBINSON, on retirement in 1926 from the service of the Federated Malay States Museums, brought to England a large collection of Malaysian mammals with the intention of using it as the foundation of a book. Unfortunately, he had done little before his death occurred, and the late C. B. Kloss, who had agreed to continue the work, for various reasons was unable to do so; the collection later passed to the British Museum (Natural History).

Although some of the material has been listed and described by Robinson, Kloss or by these authors jointly, in papers published during 1908–1920, a large part of the collection consists of specimens upon which little or no published work has been based. These include collections made in East Java and Peninsular Siam, areas hitherto poorly represented in London. There are also specimens from the original series upon which Robinson, Kloss and Chasen based numerous races of Malaysian mammals. These are a valuable supplement to the extensive collection of Malaysian type specimens (mostly named by these authors) now in the collection of the British Museum (Natural History), a list of which appears in Gibson-Hill (1949).

An attempt has been made here to make a critical evaluation of the now greatly increased Malaysian collection of the British Museum (Natural History). Comparisons have been made with original types wherever possible; attention has been directed towards the study of clines revealed by the long series now available for some species, while island races have been compared with the mainland form rather than with each other. Except where new synonymies have been created, no references to original descriptions are quoted in the following paper, as these are adequately listed by Chasen (1940) and by Ellerman and Morrison-Scott (1951) (1955). Papers and other works to which reference is made in the text are listed in a terminal bibliography. Specimens are listed under their British Museum registration numbers.

Unless otherwise stated, measurements of linear dimensions are in millimetres. Where these appear in the text, a standard form of quotation has been adopted throughout: minimum and maximum values for each series examined are given first, in that order, followed by the arithmetic mean (in parentheses) for the series. It has been found advantageous in some instances to evaluate the standard error of the mean. For samples of fifteen specimens or less the standard deviation from the mean required in this calculation has been evaluated according to the formula  $\sigma = \sqrt{\frac{\sum d^2}{N-1}}$ , and for larger samples

the formula  $\sigma = \sqrt{\frac{\sum d^2}{N}}$  has been used, where  $\sigma$  = standard deviation,  $\sum d^2$  = the sum of the squared deviations from the sample mean and  $N$  = the number of specimens sampled.

Pahang; ♀ 55.1219 Gunong Tahan, 3,300 ft. ♀ 55.1220 Wray's Camp, Gunong Tahan, 3,000 ft. ♀ 55.1221 Telom, Perak-Pahang boundary, 3,500 ft.

*Tupaia glis glis* occurs on Penang Island; in Upper Perak and probably in southern Kedah; in the north of Pahang (perhaps as far south as the Pahang River) and in Kelantan and Patani; it extends northward along the east coast of Peninsular Siam as far as Bandon. Dorsally, it is not so brightly rufous as *T. g. ferruginea* from localities further south, but, like this race, is ferruginous on the shoulders. There is little variation in colour over the range; reflectometer readings (Figs. 1, 2) show that specimens from Penang Island are slightly darker on the foreback than those from Bandon and that throughout the range the hindback is rather darker than the foreback. A few specimens from Gunong Tahan and Telom River in northern Pahang are more rufous on the back than topotypes from Penang Island and hereabouts the typical race evidently intergrades with *T. g. ferruginea*.

Variations in size occur over the range; specimens from Upper Perak, northern Pahang and Kelantan differ from those from Penang Island and Bandon in their slightly greater average size (Table I).

Table I—MEASUREMENTS OF  
*Tupaia glis* FROM THE MALAY PENINSULA AND ADJACENT ISLANDS

Locality	Head and Body			Tail			Condyllobasal Length		
	No. of specimens			No. of specimens			No. of specimens		
		Range	Mean		Range	Mean		Range	Mean
<i>T. g. glis</i>									
Penang Island	10	163—181	169	10	146—165	156	15	45.3—48.7	46.8
Perak, Pahang	20	162—191	180	20	146—191	161	15	47.0—51.8	49.0
Bandon	9	160—184	173	9	143—165	159	8	46.0—49.8	47.0
<i>T. g. ferruginea</i>									
Singapore Island	16	175—192	182	15	153—173	160	14	46.7—50.4	48.6
Johore, Negeri Sembilan	12	170—186	178	12	150—178	164	11	47.4—50.2	48.9
Selangor, Perak, Pahang	30	168—210	185	30	156—188	170	24	47.3—51.7	48.9
<i>T. g. wilkinsoni</i>									
Kedah, Perlis, Trang.	17	163—201	179	17	141—175	161	17	45.4—49.2	47.5
<i>T. g. clarissa</i>									
Krabi	10	150—172	162	10	148—178	167	10	42.8—47.8	44.3
Peninsular Siam, Tenasserim	22	168—191	179	22	142—186	165	19	43.7—49.0	47.1
Mergui Archipelago	6	160—180	176	6	144—160	151	3	45.8—49.0	47.7
<i>T. g. belangeri</i>									
Peninsular Siam, Tenasserim	22	155—182	170	22	156—187	172	14	44.8—47.5	46.1
<i>T. g. olivacea</i>									
Bangkok	4	187—195	190	4	180—190	185	3	48.8—50.2	—
<i>T. g. dissimilis</i>									
Pulau Condore	4	162—178	167	4	169—175	171	3	43.3—45.7	—
<i>T. g. operosa</i>									
Koh Samui	10	151—181	165	10	144—170	157	10	42.4—44.7	43.6

Table I—continued

Locality	Head and Body			Tail			Condylebasal Length		
	No. of Specimens	Range	Mean	No. of Specimens	Range	Mean	No. of Specimens	Range	Mean
<i>T. g. ultima</i> Koh Penan .. ..	5	161—172	166	5	162—175	166	5	42.2—44.5	43.5
<i>T. g. longicauda</i> East Perhentian Island .. ..	12	167—187	179	12	173—200	187	12	46.9—48.1	47.4
<i>T. g. obscura</i> Great Redang Island .. ..	6	165—173	169	6	163—180	170	4	44.0—45.0	44.7
<i>T. g. sordida</i> Pulau Tioman .. ..	10	156—185	168	10	138—148	143	11	43.6—47.2	45.7
<i>T. g. pulchra</i> Pulau Aor .. ..	6	179—191	186	6	173—185	177	5	47.5—48.5	48.1
<i>T. g. pemanggilis</i> Pulau Pemanggil .. ..	3	174—192	—	3	161—175	—	3	47.0—48.1	—
<i>T. g. cognata</i> Pulau Panjang P. Lontar, etc..	20	153—174	164	20	132—165	147	18	45.0—47.6	46.4
<i>T. g. umbrosilis</i> Pulau Telibon .. ..	5	164—172	167	5	136—148	142	4	44.4—47.0	45.7
<i>T. g. rufiventer</i> Butang Islands .. ..	6	164—183	174	6	156—173	164	4	45.6—48.3	47.1
<i>T. g. lacernata</i> Pulau Langkawi, etc.	40	150—190	172	40	129—159	145	33	44.4—47.7	46.2
<i>T. g. dissimilis</i> Pulau Condore .. ..	4	162—178	167	4	169—175	171	3	43.3—45.7	44.4

*Tupaia glis ferruginea* Raffles

Perak: ♂ ♂ 55.1222—1223, ♀ 55.1224 Changkat Mentri, ♀ 55.1225 Slim.

Dindings: ♂ 55.1226, ♀ ♀ 55.1227—1230 Tanjung Hantu.

Pahang: ♀ ♀ 55.1231—1232 Triang, ♀ 55.1233 Punjum, Kuala Lipis, ♂ 55.1234 (skin only) Gunong Sinyum, ♂ 55.1235 Benom foothills.

Selangor: ♂ ♂ 55.1236—1239, ♀ ♀ 55.1240—1241 Cheras, Ulu Langat, ♀ 55.1242 Dusun Tua, Ulu Langat, ♂ ♂ 55.1243—1244 Menuang Gasing, Ulu Langat, 4,000 ft. ♂ ♂ 55.1245—1246, ♀ ♀ 55.1247—1248 Ginting Bedai, 1,800 ft. ♂ 55.1267 Rantau Panjang, Rawang. ♂ ♂ 55.1249—1250 Klang Gates, ♀ 55.1251 Rawang.

Negri Sembilan: ♂ 55.1252, ♀ ♀ 55.1253—1254 Ayer Kring, Negri Sembilan-Pahang border. ♀ ♀ 55.1255—1256 Gunong Tampin, 1,000—2,700 ft.

Singapore Island: ♂ ♂ 55.1257—1262, ♀ ♀ 55.1263—1266 Changi.

This race ranges from Lower Perak and southern Pahang south to Singapore Island. There is no great difference in size between specimens from Singapore Island and

those from the adjacent mainland (Table 1): specimens from Singapore Island, however, average very slightly darker on the back (Figs. 1, 2). The darkest and most rufous specimens are those from the most southerly localities: those from Lower Perak and southern Pahang are paler and less reddened on the anterior part of the back. The hindback, however, shows little variation in intensity of colour over the range, and, except in material from Singapore Island, is somewhat darker than the foreback, as in *T. g. glis* from further north. There is little variation in size over the range and no statistically significant differences in size could be found between males and females of a large series of this race (Table 2).

Table 2—COMPARISON OF MEASUREMENTS OF MALES AND FEMALES OF *Tupaia glis ferruginea*

Dimension	Sex	No. of specimens in sample	Range	Mean	Standard Deviation	Standard Error	Standard Error of Differences of Means of ♂ and ♀ $\sqrt{(\text{S.E.} \cdot \text{m})^2 + (\text{S.E.} \cdot \text{m}_2)^2}$
Head and body	♂	31	168—210	183	8.6	1.5	2.2
	♀	27	169—200	182	8.3	1.6	
Tail	♂	31	150—180	164	7.3	1.3	2.2
	♀	26	153—188	165	9.3	1.8	
Condylbasal length	♂	26	46.7—51.7	49.6	1.49	0.29	1.17
	♀	23	46.9—50.2	48.8	1.09	0.23	
Maxillary toothrow	♂	30	18.2—20.0	19.1	0.47	0.09	0.43
	♀	27	18.4—20.3	19.3	0.51	0.10	
Zygomatic width	♂	25	23.6—28.0	26.1	1.14	0.23	1.05
	♀	23	23.8—28.6	25.4	1.15	0.24	

***Tupaia glis wilkinsoni* Robinson and Kloss**

Peninsular Siam: ♂ ♂ 55.1274—1275 Ko-khau, Trang. ♂ 55.1276, ♀ 55.1277 Chong, Trang, 250 ft.

Perlis: ♂ 55.1272, ♀ 55.1273 Pelarit.

Kedah: ♀ ♀ 55.1268—1269 Gurun, 50 ft. ♂ 55.1270, ♀ 55.1271 Kedah Peak, 3,000 ft.

This race extends along the west coast of the Malay Peninsula from Kedah Peak northward to Trang in Peninsular Siam. Dorsally, it is rather paler than *T. g. glis* (Figs. 1, 2) and the rufous area of the back is confined to the rump as in *T. g. clarissa*, but *wilkinsoni* is darker on the hindback than this race. Specimens from Kedah and Perlis are very slightly more rufous on the back than those from localities further north. As in the typical race and in *ferruginea*, the hindback of *wilkinsoni* is darker than the anterior part of the back. Externally, *T. g. wilkinsoni* is about the same size as *T. g. glis* from Upper Perak: its skull, however, is nearer in size to the skulls of specimens of the latter race from Bandon.

*Tupaia glis clarissa* Thomas

1917 *Tupaia clarissa* Thomas, J. Bombay Nat. Hist. Soc., 25: 200. Bankachon, Victoria Province, Tenasserim.

1917 *Tupaia belangeri tenaster* Thomas, J. Bombay Nat. Hist. Soc., 25: 201. Tagoot, Great Tenasserim River, Tenasserim.

Peninsular Siam: ♂ ♂ 55.1278-1282, ♀ ♀ 55.1283-1287 Nongkok, Grabi (=Krabi). ♀ 55.1299 Tang Prau, Tahuatung. ♂ ♂ 55.1288-1290, ♀ ♀ 55.1291-1294 Tasan, Chumpawn, 220 ft. ♂ 55.1295, Renong River. ♂ 55.1296, ♀ ♀ 55.1297-1298 Tapli, (=Klong Wan), Pakchan. ♀ 55.1303 Koh Rah, Takopah.

The range of this race extends from Takopah and Tahuatung northward along the west coast of the Malay Peninsula to central Tenasserim. Just north of Pakchan, at Maprit, Patiyu, it apparently extends completely across the Peninsula: specimens from Koh Lak on the east coast (at about 11° 45' N.), a little north of Patiyu, however, should be referred to *T. g. belangeri*. Specimens from Sir John Hayes Island, Hastings Island, Sir John Malcolm Island and Kisseraing Island are referred to *T. g. clarissa*. Dorsally, *T. g. clarissa* has the hindback paler than in *T. g. wilkinsoni*: in *clarissa* the hindquarters are ochraceous and not ferruginous or rufous as in the more southerly races. Anteriorly, the back is much as in *wilkinsoni*: however, specimens from the more northerly part of its range are paler above than are those from Peninsular Siam and southern Tenasserim (Figs. 1, 2). The tail of *T. g. clarissa* is buffy above and below and not grey as in *wilkinsoni*. Specimens from the more southerly islands of the Mergui Archipelago are slightly darker on the back than are those from the adjacent mainland. *T. g. brunetta* from the northern islands (King, Tavoy, Ross) is darker above than *clarissa*, especially on the hindback. Specimens from King Island are darkest: the type and another specimen gave reflectometer readings on the foreback of 14.5 and 15.0 and on the hindback of 12.0 and 11.0, while a third specimen from the same island gave values of 18.0 and 15.0 for these areas. Twelve specimens from Ross and Tavoy Islands gave values of 17.0-19.0 (18.3) on the foreback and 14.0-16.0 (15.0) on the hindback when illuminated with deep red light.

There seems little to justify the retention of *T. g. tenaster*. The type and five specimens of this race from the type locality or its immediate neighbourhood agree perfectly in colour with *clarissa*: in general the rump is ochraceous (Chasen (1940) suggests that *tenaster* has little or no ochraceous on the lower back) although one example from Tagoot resembles *belangeri* in that there is no ochraceous on the back. The length of the snout, which Thomas said to be greater in *clarissa* than in *tenaster*, is found in a large series of the former to vary widely. Thomas gave the following values for the distance from gnathion to the concavity of the front edge of orbit above the lacrymal projection: in *clarissa* (seven specimens) 24.0-25.2 (24.4) and in *tenaster* (seven specimens) 22.0-23.3 (22.4). Nineteen skulls of *clarissa* give values for this measurement of 21.5-25.3 (23.7).

Ten specimens from Krabi, on the mainland opposite Junk Seylon, are provisionally referred to this race. Although darker on the hindback than *clarissa* from further north they are not as dark dorsally as *wilkinsoni* and in most of them the well defined ochraceous or rufous rump patch is absent. The tails are buffy as in *clarissa*. These specimens are much reduced in size when compared with *wilkinsoni* and *clarissa* (Table 1). Specimens from Krabi closely resemble *T. g. cognata* from the adjacent islands but have the tail longer and more rufous and the skull rather larger than in this race: they are also slightly paler on the back.

*Tupaia glis belangeri* (Wagner)

Peninsular Siam: ♂ ♂ 55.1304–1306, ♀ 55.1307 Hat Sanuk, near Koh Lak. ♂ ♂ 55.1308–1311 Koh Lak, off east coast, about 11° 45' N.

Dorsally, this race is olive grey, tinged with buffy, and lacks ochraceous shoulder or rump patches. When present, a barely appreciable orange tinge extends over the entire back. *Tupaia glis belangeri* is the palest of the Peninsular races of *Tupaia glis* and has no definite contrast in intensity of colour between the hindback and the foreback; both are equally bright (Figs. 1, 2). Material from Koh Lak was placed by Chasen (1940) in *T. g. tenaster* (= *T. g. clarissa*) a race ochraceous on the lower back; these specimens, however, have no ochraceous dorsally and are referable to *belangeri*. This race intergrades with *clarissa* in central Tenasserim and extends northward into Lower Burma: it occurs in western Siam (Mewong River; Me Ping River, north of Raheng; Muang Pai, 19° 30' N, 98° 30' E); in south-west Siam and along the east coast of the Malay Peninsula as far south as Koh Lak.

*Tupaia glis olivacea* Kloss

Siam: ♂ 55.1312, ♀ ♀ 55.1313–1314 Bangkok.

This race may be distinguished from *T. g. belangeri* from south-west Siam and from *T. g. concolor* from south-east Siam by its greenish olive upper surface. It is rather larger than *belangeri* and apparently occurs only in the area between the Diao Chin (Tachin) and Chao Bhraya (Chao Phraya) Rivers. ♀ 55.1313 is slaty grey above and not olive, while ♂ 55.1312 has a diffuse ochraceous patch at the base of the throat.

*Tupaia glis dissimilis* (Ellis)

Pulau Condore, off Cochin China: ♂ ♂ 55.1404–1405, ♀ ♀ 55.1406–1407.

This race is similar to *T. g. belangeri* but is more richly coloured and more ochraceous on the back, especially on the rump. The tail is lighter in colour, the hairs on its dorsal surface tipped with ochraceous or buffy and the underparts and underside of the tail are more ochraceous than in *T. g. belangeri*.

*Tupaia glis operosa* Robinson and Kloss

Koh Samui, off Bandon, Peninsular Siam: ♂ ♂ 55.1315–1318, 55.1321, ♀ ♀ 55.1319–1320, 55.1322–1324.

These specimens are from the original series. They are brownish or slightly ferruginous above and in intensity of colour resemble *T. g. glis* from Bandon. They differ from this race, however, and resemble *T. g. belangeri* from Koh Lak in an almost complete absence of rufous or ochraceous from the back. The hindquarters are darker than the foreback as in *T. g. glis*. Externally, *operosa* averages slightly smaller than *glis* or *belangeri*; compared with these forms the skull is considerably reduced in size.

*Tupaia glis ultima* Robinson and Kloss

Koh Pennan, off Bandon, Peninsular Siam: ♂ ♂ 55.1325–1326, ♀ ♀ 55.1327–1328.

*Tupaia glis ultima* seems only weakly separable from *T. g. operosa*. The hindback is slightly darker than in *operosa*: the foreback, however, closely resembles that of *belangeri* from Koh Lak and south-western Siam. *T. g. ultima* lacks the faint tinge of ferruginous present on the back of some specimens of *operosa*. These specimens are

from the original series and are about the same size as *operosa*; the rostrum, which is shorter in both *operosa* and *ultima* than in *belangeri*, is about the same length in *ultima* as in *operosa* and is not shorter in *ultima* as suggested by Robinson and Kloss in the original description. Measurements of the distance from gnathion to notch below lachrymal projection on anterior edge of orbit: in five specimens of *ultima* 17.8–19.1 (18.5); in eleven specimens of *operosa* 17.8–19.1 (18.4) and in eighteen specimens of *belangeri* 18.9–21.5 (19.6).

#### *Tupaia glis longicauda* Kloss

East Perhentian Island, off Kelantan: ♂♂ 55.1329–1332, ♀♀ 55.1333–1336.

*Tupaia glis longicauda* resembles *T. g. glis* from the adjacent mainland in that the rufous colour of the hindback extends on to the shoulders, but differs from this form in its lighter coloured, less intensely rufous back (in which the hindback is darker and is contrasted with the foreback), more yellowish underparts and longer tail. These specimens are part of the original series.

#### *Tupaia glis obscura* Kloss

Great Redang Island, off Kelantan: ♂♂ 55.1337–1338, ♀ 55.1339.

This race is not unlike *T. g. wilkinsoni* but is considerably paler on the foreback; the rump is rather less rufous with a less well defined rump patch. The anterior part of the back is lightly washed with rufous while the tail is grey, tinged with buff. The underparts are paler than those of *wilkinsoni*. It is smaller and has a shorter tail than either *wilkinsoni* or *glis*.

#### *Tupaia glis sordida* Miller

Pulau Tioman, Pahang Archipelago: ♂♂ 55.1340–1344, ♀♀ 55.1345–1349.

Miller, when describing this form, compared it with '*T. ferruginea*' (= *T. g. wilkinsoni*) from Chong, Trang, Peninsular Siam. The foreback of *T. g. sordida* is identical in intensity of colour with that of *T. g. ferruginea* from Johore while the rather darker hindquarters resemble in every respect those of specimens from Singapore Island. The underparts (darker in *sordida* according to Miller) are brownish buff and may be matched with those of specimens from Singapore Island and the mainland. The tail is identical with that of *ferruginea*, and the flanks, which according to Miller are darker and browner in *sordida* than in *ferruginea*, agree well with specimens in a long series of the latter: they are slightly paler than the back, the hairs tipped with ochraceous and not with rufous. The shoulder stripes in *sordida* are more diffuse than in *ferruginea*. The principal difference between *sordida* and *ferruginea* lies in the smaller size of the former.

#### *Tupaia glis pulonis* Miller

Pulau Aor, Johore Archipelago: ♂♂ 55.1352–1353, ♀♀ 55.1354–1355.

Lyon (1913) suggested that one race of *Tupaia glis* occurred on Tioman, Aor and Pemanggil Islands. However, small but apparently constant differences separate tree-shrews from each island. *Tupaia glis sordida* is darker, richer and more ferruginous on the foreback (Figs. 3, 4) and has a less prominent shoulder stripe than either *pulonis* or *pemanggilis*: its underparts are darker and more greyish and it is smaller than either of these forms. Dorsally, the tail of *sordida* is darker: the hairs are brown and are tipped with ochraceous: the tail is grey beneath. *Tupaia glis pulonis* and *T. g. pemanggilis*

closely resemble each other: both are comparatively large forms about the size of *ferruginea* from the mainland while in both the rufous colour of the back tends to form a rump patch, the anterior part of the back being relatively lighter in colour. *Tupaia glis pulonix* is lighter in colour on the foreback than *pemangilis* or *sordida*: the hindback in all three forms remains relatively dark in colour (Figs. 3, 4). The tail of *pulonix* is grey above and below, with a buffy tinge, while in *pemangilis* the tail is darker grey above with little buff; ventrally, a wide stripe of buffy down the centre of the tail of *pulonix* is absent in *pemangilis*.

#### *Tupaia glis pemangilis* Lyon

Pulau Pemanggil, Johore Archipelago: ♂ 55.1350, ♀ 55.1351.

#### *Tupaia glis cognata* Chasen

Pulau Panjang, off west coast Peninsular Siam: ♂ ♂ 55.1356–1360, ♀ ♀ 55.1361–1366.

Pulau Lontar, off west coast Peninsular Siam: ♂ ♂ 55.1367–1369, ♂ ♀ 55.1373 (skull only), 55.1370, 55.1372 (skin only), 55.1371 Pasir Raja.

Junk Seylon, off west coast Peninsular Siam: ♂ 55.1301, ♀ 55.1302 Klong Tun Sai, Tongka, ♂ 55.1300 Telok Pales, Tongka.

These specimens are slightly darker on the back than those from Krabi, on the adjacent mainland, provisionally referred to *T. g. clarissa* in this paper. *Tupaia glis cognata* has the tail more buffy and the skull larger than the Krabi material and seems separable from *clarissa* only by its darker colour and slightly smaller size. Dorsally, although as dark as *wilkinsoni*, *cognata* lacks much of the rufous colour found in that form and has a much shorter tail.

#### *Tupaia glis umbratilis* Chasen

Pulau Telibon, off west coast Peninsular Siam: ♂ ♂ 55.1374–55.1375, ♀ ♀ 55.1376–1377.

This race is about the same size as *T. g. cognata* but may be separated from it by its darker, more rufous back and darker underparts. Dorsally, it averages darker than *wilkinsoni* from the adjacent mainland: ventrally, *umbratilis* is on the whole darker than *wilkinsoni* but its underparts may be matched by some specimens of *wilkinsoni* which are brownish beneath and which have the grey based hairs of the belly tipped with buff. *Tupaia glis umbratilis* is considerably smaller than *wilkinsoni*.

#### *Tupaia glis raviana* Lyon

Pulau Rawi, Butang Islands: ♂ 55.1378.

Pulau Adang, Butang Islands: ♂ ♂ 55.1379–1380.

*Tupaia glis raviana* is about the same size as *T. g. wilkinsoni* and can only be separated from it by small differences in colour. Although the intensity of colour on the foreback of *raviana* is much the same as in *wilkinsoni*, *raviana* has the foreback more ochraceous and less rufous and has slightly darker hindquarters. The tail of *raviana* is more buffy than that of *wilkinsoni*. The specimens examined do not support the statements of Lyon (1911) and (1913) that *raviana* has a wider skull, wider rostrum, wider interorbital region and more spreading zygomatica than either *lacernata* from Langkawi and Teratau or 'belangeri' (= *wilkinsoni*) from the adjacent mainland. Cranial measurements of *T. g. wilkinsoni*: width of rostrum at incisors (twenty specimens) 5.9–7.0 (6.6), interorbital breadth (twenty specimens) 13.4–15.0 (14.2) and zygomatic width

(nineteen specimens 23.5–26.0 (24.4). Of *T. g. lacernata*: width of rostrum at incisors (thirty-six specimens) 5.8–7.0 (6.4), interorbital breadth (thirty-seven specimens) 12.6–14.9 (14.1) and zygomatic width (thirty-three specimens) 23.5–26.0 (24.8). Of *T. g. raviana*: width of rostrum at incisors (four specimens) 6.4–7.0 (6.7), interorbital breadth (four specimens) 14.2–14.5 (14.4) and zygomatic width (four specimens) 24.9–26.3 (25.4).

*Tupaia glis lacernata* Thomas and Wroughton

Pulau Langkawi, off Perlis: ♂ 55.1381 Kuala Kubong Badak, ♂ ♂ 55.1382–1384, ♀ ♀ 55.1385–1387.

Pulau Dayang Bunting, Langkawi islands: ♂ ♂ 55.1388–1391, ♀ ♀ 55.1392–1393.

Pulau Terutau, off west coast Peninsular Siam: ♂ ♂ 55.1394–1395, ♀ 55.1396 Telok Udang, ♀ 55.1397 Telok Wau. ♂ ♂ 55.1398–1400, ♀ ♀ 55.1401–1403.

*Tupaia glis lacernata* is darker and more rufous above than its nearest mainland neighbour, *T. g. wilkinsoni*. It is as rufous above as *T. g. glis*, but differs from these mainland races in its smaller size and shorter tail and from *raviana* in its darker back and much shorter tail. Although the majority of specimens are rufous or ferruginous on the rump and shoulders, a few in which the rufous tints are almost entirely lacking occur among a large series. Such specimens are dark brown above.

Variations in the dorsal colour of *Tupaia glis* from the Malay Peninsula and the adjacent coastal islands

Variations in the brightness of the colour of the foreback and hindback of *Tupaia glis* from the Malay Peninsula and its nearby coastal islands as measured by a reflectometer (using as an illuminant deep red light of wavelength 6,500 Å and above; the filter employed has a peak transmission at about 7,100 Å and from thence into the infra-red) are set out in the form of population-range diagrams (Figs. 1–4). These have been prepared according to the methods of Dice and Leraas (1936) and Hubbs and Perlmutter (1942). The length of each ordinate represents the extremes of each set of readings and a central crossbar the mean; a narrow rectangle is formed by joining the extremities of crossbars placed at a distance equal to one standard deviation from the mean on each side of the mean, while the broad, partially dotted rectangle is formed by similarly joining crossbars placed at a distance equal to twice the standard error of the mean on each side of the mean. Hubbs and Perlmutter (1942) consider that subspecific difference between samples (if these show normal variation) is indicated when the rectangles representing standard deviations from the mean of each sample do not overlap; Linsley, Mayr and Usinger (1953), however, suggest the use of a higher standard of subspecific difference, i.e. that represented by non-overlap of rectangles obtained by similarly plotting one and one half standard deviations on each side of the mean. The significance of the difference between any two means may be obtained by comparing the relative length and the relative separation or overlap of rectangles formed on the standard error crossbars (placed at  $2 \sigma M$  on either side of the mean) of two comparable lines. Tables of critical ratios ( $t$  values) and of probabilities for this purpose are given by Hubbs and Perlmutter (1942).

Having regard to mainland races, it is seen immediately that in this species comparatively pale (high reflectometer readings) forms inhabiting the north of the Malay Peninsula give way in a southerly direction to darker (low reflectometer readings) forms.

and that this increasing degree of darkening in a north-south direction is not uniform over the entire back. While the hindquarters darken rapidly, the forequarters darken more gradually. In this way, while specimens from the extreme north of the Peninsula and from Singapore Island are as dark, or nearly as dark on the foreback as on the hindback, those from intermediate localities and from many of the islands show a considerable degree of contrast between the fore and hindquarters. The gradual deepening of the dorsal colour in a north-south direction is accompanied by an increase of the ochraceous or (further south) rufous element of the pelage. *Tupaia glis siccata* and *T. g. belangeri*, the most northerly races considered, show little or no ochraceous dorsally and are predominantly greyish in colour: these, the palest races examined, are succeeded by *clarissa*, a slightly darker race in which ochraceous appears on the rump. Rufous appears on the rump and to a lesser extent on the forequarters of *wilkinsoni*: in *glis* this colour is much intensified but this race, like *ferruginea* from the northern parts of its range, has the foreback paler than and contrasted with the hindback. *Tupaia glis ferruginea* from Johore and Singapore Island is a dark, intensely rufous form with little dorsal contrast. Generally, there is little variation in size; a reduction in size is found in specimens from Krabi, and, to a lesser extent, from Bandon, in the southern part of Peninsular Siam.

Island races follow a similar sequence in dorsal colour variation. On the islands of the east coast, colour phases similar to those of the mainland do not appear at the same latitude as on the mainland, but at more southerly latitudes. Thus, *operosa* and *ultima* from Koh Samui and Koh Pennan at the latitude of Bandon, although as dark above as *T. g. glis*, resemble *belangeri* in the almost complete absence of ochraceous or rufous from their dorsal pelage. *Tupaia glis kohtauensis* Shamel (1930) from Koh Tau, a little to the north of these islands, appears on description to be closely similar to *ultima* and *operosa*. Like these races, it has a smaller skull and a shorter, blunter rostrum than the mainland forms. While dark on the back, it apparently lacks rufous or ochraceous dorsal colour. The tendency to form a diffuse, blackish rump patch found in some specimens from Bandon and to a greater extent in *ultima* appears further developed in *kohtauensis* and the back is stated by Shamel to be blackish. *Tupaia glis longicauda* and *obscura* resemble *wilkinsoni* and *clarissa* and not *glis* of the nearby mainland, while fully ferruginous forms appear at the Pahang-Johore Archipelago. Of these, *sordidu* is the darkest, and together with *pemangilis* and *putonis* has the hindback as dark as *ferruginea*. The forequarters of these two latter races, however, are paler and resemble *glis*. The retardation of the appearance of rufous colour in these east coast island races is perhaps due to more rigorous conditions on these exposed islands.

By contrast, the west coast island races are generally darker than their nearest mainland neighbours and resemble those from more southerly latitudes. *Tupaia glis brunetta* from the northern Mergui Archipelago is similar in intensity of colour to *glis* while *clarissa* from the southern islands is darker than mainland *clarissa*. While *cognata* resembles *clarissa*, *umbratilis* and *raviana* are almost inseparable on colour from *wilkinsoni*, and *lacernata* resembles *glis*. On the small islands to the south of the Peninsula, the forms *castanea*, *batamana* and *redacta* are deeply ferruginous or rufous and differ only from *ferruginea* in small details of size and colour. There is little contrast between the fore and hindquarters.

The variation of dorsal colour in *Tupaia glis* of the Malay Peninsula, therefore, apparently follows a cline. Variation in the intensity of melanin pigmentation of the

dorsal surface of the body (on which much of the racial classification is based) is comparatively regular and is most probably correlated with climatic factors: it may in fact illustrate Gloger's rule that the intensity of melanin pigmentation tends to decrease with mean temperature. Humidity also affects the deposition of melanin: blackish eumelanins appear under conditions of high humidity and high temperature, while reddish brown phaeomelanins appear under conditions of lower humidity and high temperature. Lower temperatures with low humidities favour the production of greys and grey browns. Variations in size and in the relative proportions of the head and body are confined to island races (except for the curious reduction in size of the mainland form from Krabi and Bandon) and together with small variations of tail colour or of the colour of the underparts, constitute their principal diagnostic characters.

Lyon (1913) recognised three species in the Malay Peninsula: *belangeri*, which he placed in the *chinensis* group; *lacernata*, including *wilkinsoni*, *lacernata*, *raviana*, *obscura* and *longicauda* and which constituted the *wilkinsoni* subgroup of the *ferruginea* group; and *glis*, including *ferruginea*, *glis*, *batamana*, *sordida*, *pemongillis* and *pulonis*, constituting the *ferruginea* subgroup of the *ferruginea* group. The divisions between the groups were based entirely on colour, except in the case of *chinensis*, which has a mammary formula of 3-3 = 6 and not 2-2 = 4 as in the more southerly groups. The essential unity of the Malaysian races was later recognised by Chasen (1940) who listed all these forms and those later named as races of *Tupaia glis*. His arrangement has been adopted here, partly for convenience and partly because further specimens are required, particularly from Peninsular Siam north of Bandon, to fill gaps in the series examined. The data obtained from this series, however, raise the question of the validity of Peninsular races based almost entirely on characters of dorsal colour.

Applying to the results expressed in Figs. 1-2 the criterion of Linsley, Mayr and Usinger (1953) that non-overlap between comparable rectangles plotted between crossbars placed one and one half standard deviations from the mean indicates subspecific difference (i.e. approximately 97 per cent of one population differs statistically from approximately 97 per cent of the population with which it is compared) a clear division on the basis of dorsal colour is immediately apparent between a northern race and a southern race. These terminal series are separated by a number of intergrading populations: in some cases adjacent populations are separated by differences of probable significance (indicated by non-overlap of the standard error rectangles of comparable lines) but these differences are insufficiently great to warrant further subspecific distinction. An intermediate race is not justified by these figures: a wide overlap exists in the values for the intermediate populations and it is clear from the diagrams that the change from a pallid northern race to a much darker southern one is gradual. It seems, therefore, that in the Malay Peninsula *Tupaia glis* is represented in the north by a pallid, brownish form with little or no ochraceous back colour (*belangeri*, *siccata*) and in the south by a much darker, heavily rufous form (*ferruginea*). These are linked by a number of intermediate forms of varying dorsal colouration (*glis*, *wilkinsoni*, *clarissa*) in which the rufous of *ferruginea* is replaced in a south-north direction by ochraceous, but which, on this character alone, do not warrant subspecific distinction. Local variations of the colour variations exhibited on the mainland appear on the adjacent coastal islands: owing perhaps to the very local nature of the climate of these islands, such variations do not correspond closely with the geographically nearest mainland phase.

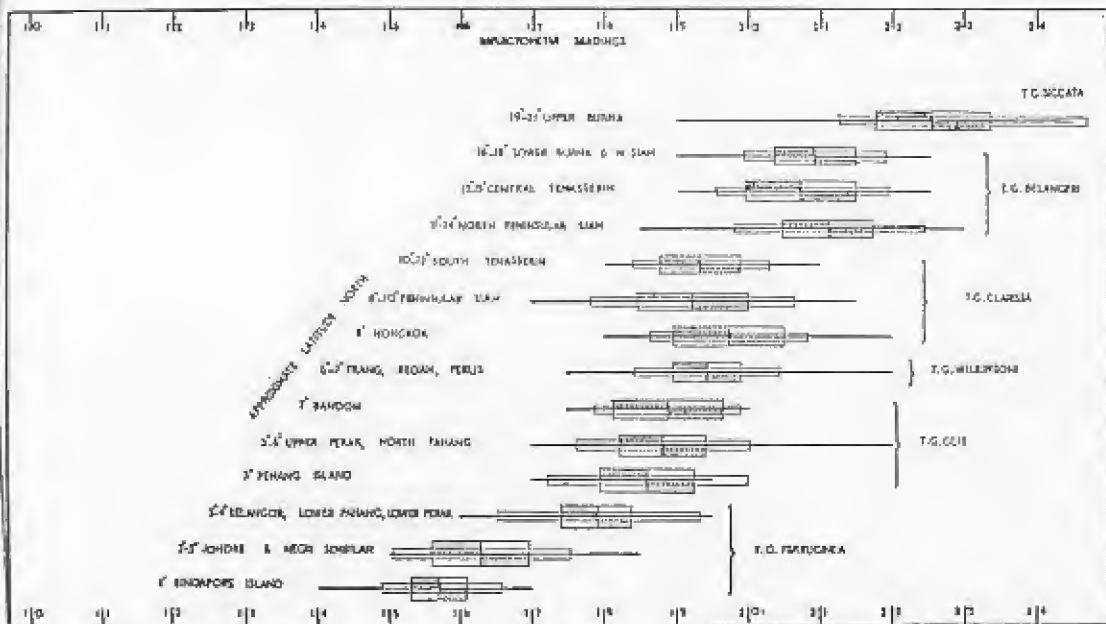


FIGURE 1. Reflectometer readings taken on the foreback of *Tupaia glis* from the mainland of the Malay Peninsula. (Ilford Filter No. 609).

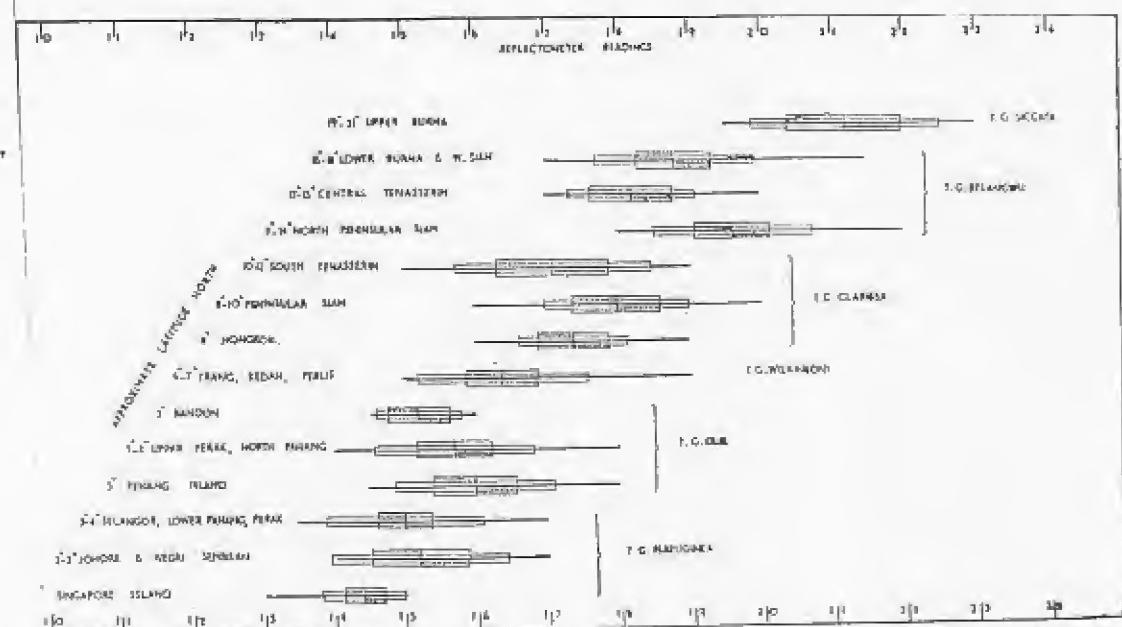


FIGURE 2. Reflectometer readings taken on the hindback of *Tupaia glis* from the mainland of the Malay Peninsula. (Ilford Filter No. 609).

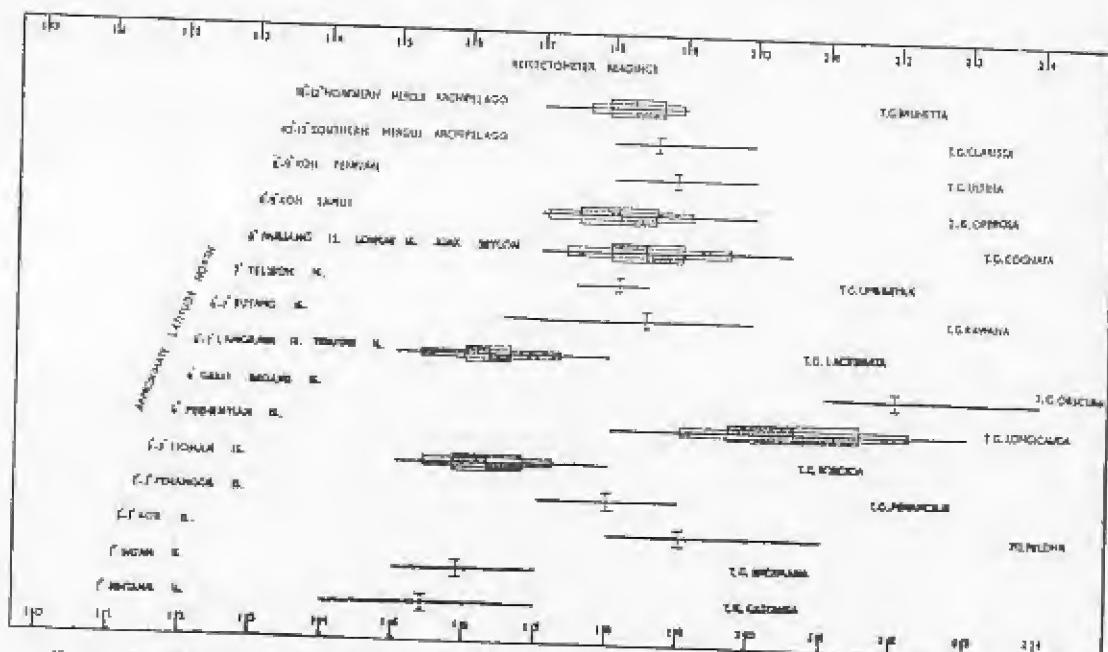


FIGURE 3. Reflectometer readings taken on the foreback of *Tupaia glis* from the islands adjacent to the Malay Peninsula. (Ilford Filter No. 609).

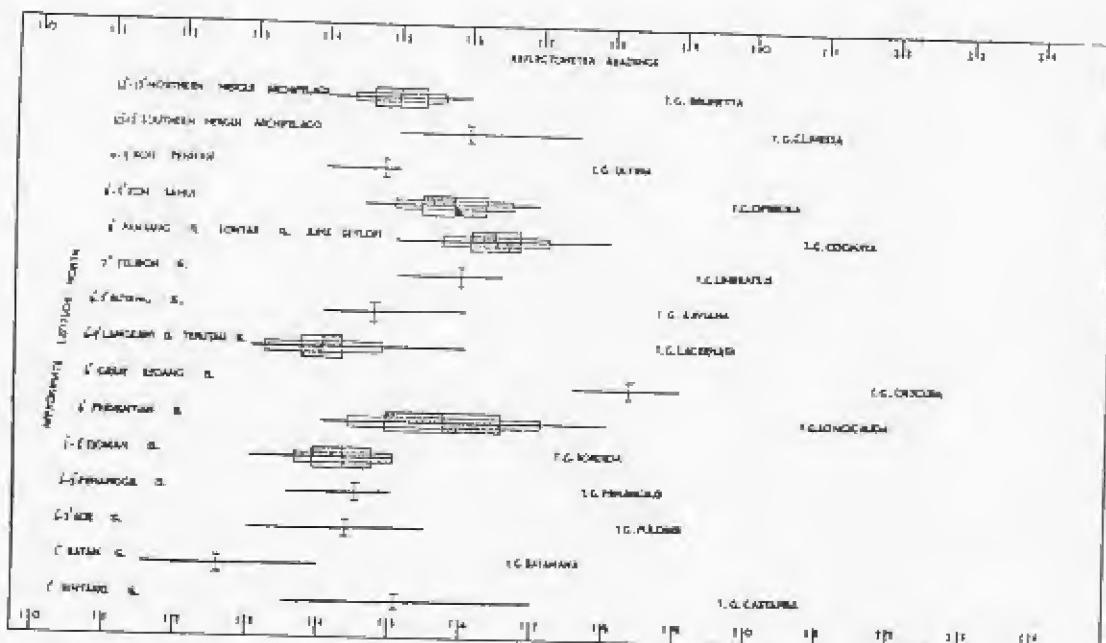


FIGURE 4. Reflectometer readings taken on the hindback of *Tupaia glis* from the islands adjacent to the Malay Peninsula. (Ilford Filter No. 609).

**Tupaia glis jacki** Robinson and Kloss

The type specimen of this race was thought by Gibson-Hill (1949) to be lost. However, it is 19.11.5.17, a skin and skull, and was presented in 1919 by the Federated Malay States Museums among a collection of mammals made by Robinson and Kloss in Sumatra. With it are two ♀ paratypes, 19.11.5.18-19.

**Tupaia glis siberu** Chasen and Kloss

West Sumatra: ♂ 28.11.2.3 (the type specimen), Siberut Island, Mentawi Islands.

**Tupaia glis chrysogaster** Miller

West Sumatra: ♂ 28.11.2.4, Sipora Island, Mentawi Islands.

**Tupaia glis hypochrysa** Thomas

West Java: ♀ 54.63 Tjibodas, 5,000 ft.

Middle Java: ♂ 54.64 Karangbolang, 100 ft.

The underparts of 54.63 are paler and more ochraceous than those of the type (hitherto the only specimen of this race in the collection of the British Museum (Natural History)); both specimens agree with the type in all other respects. Measurements (female in parentheses): head and body 189 (178), tail 181 (167), hindfoot 46.5 (44), ear 16 (17), condylobasal length 48.3 (50.0), zygomatic width 25.6 (26.5), width of braincase 20.4 (19.4) and maxillary toothrow 19.3 (19.8). Mammary formula 3-3=6.

**Tupaia glis longipes** Thomas

Sarawak: ♂ 55.663 Anyut, Sarebas, ♀ 55.664 Betong, Sarebas.

Although referred to *longipes*, these young adult specimens are intermediate in some respects between examples of this race from more northerly localities and those described below as *T. g. salatana*. Five specimens from Batang, Kalulong and Spitang agree closely with the type of *longipes*. Dorsally, they are olivaceous brown, speckled with ochraceous, especially on the neck and nape. The orange rufous shoulder stripes are indistinct. Dorsally, the tail is concolorous with the back. Ventrally, they are ochraceous or buffy: a wide stripe of buffy extends along the median line of the tail. Those from Sarebas are less darkly brown and more rufous on the back; the orange rufous shoulder stripes are more distinct; ventrally they closely resemble more northerly specimens but the central stripe of the tail in the Sarebas material is rufous.

**Tupaia glis salatana** Lyon

Sarawak: ♂ 55.665 Mora Barue, Samarahan, ♂ 55.666. No precise locality: from other collecting data the specimen appears to have been collected in the neighbourhood of Entawa, Samarahan.

These specimens are referred (on description) to *T. g. salatana*. They are more richly coloured than *longipes* and can be separated from it easily by the redder, more brightly coloured underside of the tail. Dorsally, these specimens are rufous or ferruginous and are similar to the forms *ferruginea*, *batamana* and *castana* from the southern part of the Malay Peninsula and its adjacent islands. The anterior part of the back in this material from south-west Sarawak is lighter in colour than the rump, and is richly rufous with prominent orange rufous shoulder stripes. The underside is more rufous than in *longipes*, and the central spine of the tail is rufous beneath, not ochraceous or buffy as in the northern race. Variations in colour of *Tupaia glis* in Sarawak are described by Chasen and Kloss (1931) and Chasen (1933).

Insufficient material is available to determine trends in colour variation in this species outside the Malay Peninsula. Dark, more or less ferruginous forms occur in Sumatra, in western Java and on the islands of the South China Sea. Sufficient material exists to suggest that the southern and western parts of Borneo are occupied by a dark, ferruginous form (*salatana*) and the north-eastern part of the island by a paler more ochraceous form (*longipes*). These in Borneo seem to correspond with the phases *ferruginea* and *glis* or even *wilkinsoni*, respectively, on the Malayan mainland.

#### *Tupaia montana montana* Thomas

Sarawak: ♂♂ 55.667-669, ♀♀ 55.670-674 Mount Dulit, 3,300-3,500 ft. ♀ 55.675 Gunong Sidong, Samarahan, 1,200 ft.

Specimens from the highlands of south-west Borneo may prove racially distinct from *T. m. montana* (Mount Dulit) and *T. m. baluensis* (Mount Kinabalu). One from Gunong Sidong, Samarahan, has a blacker, less rufous tail than *montana* and the black dorsal patch over the hindquarters in this specimen is represented by a narrow line of dark hairs in the centre of the back. The extent of this patch, however, varies considerably in a series from Mount Dulit and in some of these specimens the median dorsal stripe on the forepart of the back is obsolescent. There is little trace of this stripe in the specimen from Samarahan.

#### *Tupaia javanica* Horsfield

1822 *Tupaia javanica* Horsfield, Zool. Researches in Java, (3). Near Banjoewangi, East Java.

1913 *Tupaia javanica balina* Thomas, Ann. Mag. Nat. Hist. 2: 205. Bali.

1918 *Tupaia javanica occidentalis* Robinson and Kloss, Journ. Fed. Malay States Mus., 8 (2): 16. Sungai Penoh, Kerinch Valley, west Sumatra.

1937 *Tupaia javanica bogoriensis* Sody, Temminckia, 2: 213. Buitenzorg, west Java.

1937 *Tupaia javanica tjabruensis* Sody, Temminckia, 2: 213. Bandoeng, west Java.

East Java: ♂♂ 54.65-66, ♀♀ 54.67-69 Sodong Jerok, Idjen Massif, near Banjoewangi, 3,900 ft.

Middle Java: ♀ 54.73 Karangbolang, 100 ft.

West Java: ♂ 54.70, ♀ 54.71 Tjibodas, Geger Banteng, Mount Gedeh, 4,000-5,500 ft. ♂ 54.72 Kandang Badah, Mount Gedeh, 9,000 ft. ♂♂ 54.74-75 Wynkoops Bay, 100 ft. ♀♀ 54.76-77 Oedjoengteboe, 1,000 ft.

Robinson and Kloss separated west Javan and Sumatran specimens (*T. j. occidentalis*) from those of east Java (*T. j. javanica*) on grounds of more ochraceous or yellow underparts, broader rostrum and wider interval between the incisors in *occidentalis*. A large series of specimens (including the types of *javanica*, *occidentalis* and *balina*) from various localities in Java and Sumatra suggests that the colour of the underparts is so variable that it is unreliable as a taxonomic character, specimens from the same locality varying in this respect from plain grey to heavily ochraceous. The type of *occidentalis*, which is ochraceous beneath, may be matched with a specimen from Sodong Jerok and with the type and a paratype of *balina*. Others from Pajo, Kerinch and the Barisan Range, Sumatra are grey or grey with a little ochraceous on the underparts, as are specimens from west Java (Buitenzorg, Tji Wangie, Tjilatjap, Tasikmalaga) and east Java (Sodong Jerok). Generally, hairs on the forearms, flanks and tail are tipped with ochraceous: hairs tipped with rufous occur occasionally in specimens from Sodong Jerok and Bali but also in specimens from Wynkoops Bay and Tji Gombong, west Java.

These considerations apply also to *bogoriensis* and *tjibruniensis*, both of which were separated by Sody on grounds of colour. The colour of the upperparts varies considerably in the series examined, specimens with light coloured backs (= *bogoriensis*) and dark coloured backs (= *tjibruniensis*) not infrequently occurring in series from the same locality. Chasen (1940) synonymised these races with *occidentalis* while *T. j. balina* (for a note on this race see Sody (1933)) he placed in *T. j. javanica*.

Cranial measurements of *Tupaia javanica* from west Java and Sumatra: rostral width at the diastema 5.6–6.3 (6.0) (thirty-four specimens), interval between incisors ( $i^2-i^2$ ) 1.5–2.0 (1.8) (thirty-three specimens). Six specimens from east Java measure: rostral width at the diastema 5.6–6.0 (5.8), interval between incisors ( $i^2-i^2$ ) 1.7–2.0 (1.9).

#### *Tupaia minor minor* Günther

Sarawak: ♂ 55.677 Udan, Paku, Sarebas, ♀ 55.676 Paku, Sarebas, ♂ 55.683 Lingit, Sarebas, ♀ 55.680–681 Sungai Pelanduk, Paku, Sarebas, ♂ 55.679 Entawa, Samarahan, ♂ 55.678 Sungai Lenin, Tinjar River, Baram.

These specimens are darker and redder on the back than *T. m. caedis* from the extreme north of Borneo: the shoulder stripe is broad, distinct and white rather than narrow, indistinct and with a buffy tinge as in the northern race. Five specimens from central and south central Borneo are slightly paler and less russet on the back with less distinct shoulder stripes than those from Sarawak.

#### *Tupaia minor malaccana* Anderson.

Perak: ♂ 55.1413 Temengoh.  
Pahang: ♂ 55.1414 Labang Endau, east coast, ♀ 55.1416 Benom foothills.  
Selangor: ♂ ♂ 55.1408–1409 Cheras, ♀ ♀ 55.1410–1411 Kuala Lumpur, ♂ 55.1415 Klang Gates, ♀ 55.1418 Batu.  
Negeri Sembilan: ♀ 55.1417 Bukit Tampin.  
Malacca: ♂ 55.1412 Nyalas.  
No locality: 55.1419 (skull only).

*Tupaia minor malaccana* differs only slightly from *T. m. minor*. There is little russet on the hindback and the tail is less black; ventrally, the underparts of *malaccana* are a little more ochraceous and the central stripe of the tail in this race is ochraceous or orange and not buffy as in *T. m. minor*.

#### *Tupaia gracilis gracilis* Thomas

Sarawak: ♂ 55.685 Mount Dulit, Baram, ♀ 55.684 Mora Barue, Samarahan. The specimen from Samarahan, south-west Sarawak, has a slightly more grizzled tail than the type and the back is darker and more olivaceous. In the specimen from Baram the throat and fore part of the chest is ochraceous buff; the type has white underparts and a yellowish throat. The belly of the Baram specimen is strongly infused with olivaceous buff with a median streak of ochraceous buff, while the tail is grey and lacks the central line of yellowish along its underside present in the type.

#### *Tupaia dorsalis* Schlegel

Sarawak: ♂ ♂ 55.686–687 Mount Dulit, Baram, 3,400 ft. ♂ 55.689 Sungai Lenin, Tinjar River, 500 ft. ♀ 55.688 Udan, Paku, Sarebas, ♀ 55.690 Gunong Sidong, Samarahan.

There is little variation in colour in a series of sixteen skins of *Tupaia dorsalis* except in the colour of the underparts, which in some specimens are buffy rather than ochraceous.

*Tupaia tana nitida* Chasen

Sarawak: ♂ ♀ 55.692-693 Bukar, Samarahan. ♂ 55.694 Mora Barue, Samarahan.  
♂ 55.691 Ulu Anyut, Paku, Sarebas.

These specimens can be distinguished from *T. t. utara* by their comparatively much less blackened tails, brighter colour, redder forelimbs and flanks and more richly coloured underparts. 55.691 from Sarebas, however, is intermediate with *utara* and has the tail blacker and the underparts a paler, more yellow colour than *nitida*.

Specimens from south Borneo in the collection of the British Museum (Natural History) cannot be distinguished from those from Lampung in south Sumatra and should be referred to *T. t. speciosa*; *T. t. tana* appears to be restricted to north and central Sumatra, contrary to the suggestion of Lyon (1913) who thought that it also occurred over south Sumatra and southern Borneo.

*Tupaia tana utara* (Lyon)

Sarawak: ♂ 55.695, ♀ 55.696 Mount Dulit, Baram, 3,000-3,300 ft.

*Dendrogale melanura melanura* (Thomas)

Sarawak: ♂ ♂ 55.697-699, ♀ 55.700 Mount Dulit, Baram, 3,400-3,500 ft.

Little variation in colour is apparent in a small series from Mount Dulit: some specimens are a little more ochraceous ventrally than others.

*Ptilocercus lowi lowi* Gray

Sarawak: ♀ 55.662 Balingean.

*Ptilocercus lowi continentis* Thomas, from the Malay States, Sumatra and the adjacent islands, differs only slightly from *P. l. lowi*. Hitherto, *P. l. lowi* was represented in the collection of the British Museum (Natural History) by two old skins and skulls (one the type) and by a specimen in alcohol. A comparison between the type of *continentis* and a fresh skin of *P. l. lowi* shows that *continentis* can be distinguished from the typical race only by its slightly darker, greyer colour, especially on the inner surface of the legs, and by its more sparsely haired tail plume. Measurements of an adult female from Balingean: head and body 129, tail 175, hindfoot 29, ear 15, greatest length of skull 36.3, condylobasal length 35.5, palatal length 17.6, zygomatic width 21.5 and maxillary toothrow 17.2.

*Echinosorex gymnorurus gymnorurus* (Raffles)

Perak: ♀ 55.1452 Changkat Mentri.

Selangor: 55.1453 Damansara Road, Kuala Lumpur.

*Hylomys suillus suillus* Müller

West Java: ♀ 54.45 Tjibodas, Mount Gedeh, 5,000 ft.

East Java: ♂ ♂ 54.46-47, ♀ 54.48 Sodong Jerok, Idjen Massif, near Banjoe-wangie, 3,900 ft.

Javan *Hylomys* has hitherto been unrepresented in the collection of the British Museum (Natural History). These specimens have the grey based hairs of the back tipped with orange or rufous orange, especially on the rump where the hair tips are strongly rufous; on the head, cheeks and flanks the hairs are tipped with yellowish or yellowish orange. On the underside, the hairs are silvery grey, tipped to a greater or lesser extent with buffy. Measurements of three adults from Sodong Jerok and a young adult from Tjibodas appear in Table 3.

Table 3.—MEASUREMENTS OF *Mysoremys* FROM JAVA, SUMATRA AND THE MALAY PENINSULA

B.M. Reg. No.	Sex	Tail	Head and body	Hindfoot	Greatest length of skull	Cordylobasal length	Zygomatic breadth at centre of mesials	Length of brachiose of mesials	Length of mandible	Maxillary toothrow front of eye	Width rostrum in front of eye	Depth nostrum in front of eye	Interorbital breadth	Mandibular toothrow	Locality	
54.46	♂	122	18	20	18	36.4	35.3	—	9.8	12.4	27.3	18.2	5.6	9.3	14.8	16.4 East Java
54.47	♂	136	16	24	21	36.3	35.6	19.7	10.0	12.7	27.5	18.9	5.9	3.5	9.2	15.0 East Java
54.48	♀	126	18	23	17	35.2	34.1	18.9	9.5	12.1	26.5	18.2	5.3	3.5	9.4	15.1 East Java
54.45 Yg. ad.	♀	125	16	25	17	—	—	17.8	9.0	10.8	25.8	—	—	—	8.9	14.4 West Java
55.1420	♂	140	20	26	18	35.5	34.0	—	9.4	11.7	25.4	18.1	5.7	3.8	8.5	14.4 Kerinci, Sumatra
19.31.5.7	♂	136	17	26	14	38.9	35.3	20.6	10.4	12.9	28.0	19.3	6.3	4.3	8.7	15.5 Malay States
55.1421	♂	134	22	23	18	33.4	33.3	18.3	9.2	11.8	25.1	16.7	5.6	3.9	8.2	13.3 Malay States
Yg. ad.	♂	122	13	23	14	34.5	—	19.1	9.3	12.4	25.2	18.0	5.8	3.7	8.4	14.1 Peninsular Siam
55.1422	♂	139	14	23	21	36.7	35.6	19.9	9.8	11.8	27.7	18.9	5.7	3.8	8.6	15.1 Malay States
12.10.22.8	♂	143	22	24	19	35.8	33.7	—	9.7	10.5	—	17.6	5.7	3.7	8.1	13.7 Malay States

Mus. 29, 1960.

*Hylomys suillus dorsalis* Thomas

North Borneo: ♂ 55.661 Mount Kinabalu.

Dorsally more rufous than others from Kinabalu; the black dorsal stripe is very indistinct.

*Hylomys suillus maxi* Sody

Peninsular Siam: ♂ 55.1422 Tasan, Chumpawn.  
Perlis: ♂ 55.1421 Pelarit.

Kedah: ♀ 55.1424 Kedah Peak, 3,000 ft.

Perak: ♀ 55.1423 Jor, Batang Padang, 1,800 ft.

Selangor: ♂ 55.1420 Semangko Pass, Selangor-Pahang boundary.

This race seems barely separable from *H. s. suillus* of Java: in a small series from Malaya and Sumatra the tips of the hairs on the back are generally a little paler, browner and less rufous than in *suillus*. Ventrally, these specimens vary from a clear grey to a dusky tinge identical with that of the Javan specimens. An indistinct black nape stripe is present in 19.11.5.7 from Korinchi, Sumatra.

Miller (1942) found that Sumatran skulls of *Hylomys* compared with one Javan skull in the United States National Museum differed from it in their wider, deeper braincase and more robust mandibular ramus. Measurements of *Hylomys* from Sumatra and the Malay States appear in Table 3. (Miller (1942) tabulates measurements of Sumatran *Hylomys*. Under the headings "Breadth of rostrum at front of pm<sup>1</sup>" and "Depth of rostrum at front of pm<sup>1</sup>" he apparently lists the rostral dimensions measured at the front of c<sup>1</sup>).

55.1422 from Tasan, Chumpawn, is the northernmost record for this race. Chasen (1940) records *H. s. maxi* from Perlis: the lighter coloured *H. s. siamensis* he records as far south as Tapii, just above the Pakchan Estuary, in the Isthmus of Kra. Dorsally, this subadult specimen is very brown with a strong reddish tinge: the underside is clear grey.

*Crocidura tiomis* Kloss

Pulau Tioman, off Pahang: ♀ ♀ 55.1425-1426 Juara Bay.

These specimens are paratypes and their measurements appear in the original description (nos. F.M.S. 665/16 and 880/15).

*Crocidura malayana* Robinson and Kloss

Perak: ♀ 49.427 (the type specimen) Maxwell's Hill, near Taiping, 3,300 ft.

*Crocidura* sp.

Peninsular Siam: ♂ 55.1427 Khao Luong, Nakon Sri Tamarat, 2,000 ft.

Selangor: 55.1428 Bukit Fraser, Selangor-Pahang boundary, 4,200 ft.

*Galeopterus variegatus peninsulae* Thomas

Peninsular Siam: ♂ 55.1430 Tasan, Chumpawn, 220 ft.

Perlis: ♀ 55.1436 Pelarit.

Kedah: ♂ 55.1431 Gurun.

Perak: ♀ 55.1434 Larut.

Penang Island: ♂ 55.1429 Telok Bahang.

Dindings: ♂ 55.1432 Pulau Pangkor Besar.

Selangor: ♂ 55.1433 Kuala Lumpur, ♀ 55.1435 Rawang.

Males are generally brownish above; two specimens, however, 55.1432 from Dindings and 9.4.1.86 from Changi, Singapore Island, are strongly rufous, especially over the shoulders, arms and thighs and the top of the head. Females are grey, occasionally with buffy brown or brown patches on the shoulders. Measurements of specimens from the Malay Peninsula: Adult males: head and body 340–385 (369), tail 192–262 (227) (five specimens in both cases), condylobasal length 66.2–76.3 (69.3) (four specimens), maxillary toothrow 32.8–36.8 (34.8) (five specimens). Adult females: head and body 360–390 (377), tail 250–292 (272) (four specimens in both cases), condylobasal length 69.7–71.7 (71.0), maxillary toothrow 34.4–37.1 (35.9) (six specimens in both cases).

Chasen and Kloss (1929) and Chasen (1940) dubiously referred *Galeopterus* from Bintang Island to *G. v. chombolis*. Chasen (1940) suggested that material from Bintang should be separable from *chombolis* by greater size: from *temmincki* by smaller size and more clearly marked sexual dimorphism and from *peninsulae* by smaller size and richer colour. Three male and three female specimens from Bintang (9.4.1.89–94), however, should be referred to *peninsulae*. In colour, one male matches the drab material from the Peninsula: the others are more rufous and resemble the brighter material from Dindings and Changi. Females are similar to mainland specimens and have heavily marked brown shoulder patches. Measurements of two adult males from Bintang: head and body 345–365, tail 225–245, condylobasal length 69.5–69.7, maxillary toothrow 33.8–35.3. Three adult females: head and body 350–407 (373), tail 248–305 (279), condylobasal length 70.6–71.4 (two specimens), and maxillary toothrow 35.2–36.5 (35.6). Two males and two females (9.4.1.95–98) are referable to *chombolis*. They are from Karimon Island: the males are darker than the males of *peninsulae* while the females are clear, pale grey with no shoulder patches. The skins are about the same size as those measured by Lyon (1909) but the skulls are a little longer: condylobasal length in males 62.4–64.9; in females 70.1–71.1; maxillary toothrow in males 31.7–32.3; in females 32.8–33.7.

#### *Galeopterus variegatus aoris* (Miller)

Pulau Aor, Johore Archipelago: ♂ ♂ 55.1444–1445, ♀ ♀ 55.1446–1447.

#### *Galeopterus variegatus pumilus* (Miller)

Pulau Adang, Butang Islands: ♀ 55.1439.

Pulau Rawi, Butang Islands: ♀ ♀ 55.1437–1438.

Females from Pulau Rawi differ slightly from the female from Pulau Adang. Dorsally, they are a lighter grey and are less mottled with black; the feet, thighs and forearms are greyer and less brown.

#### *Galeopterus variegatus perhentianus* Chasen and Kloss

East Perhentian Island, off Kelantan: ♀ 55.1443.

This specimen (F.M.S. 2320/10) is one of a series fully described under *Galeopterus pumilus* by Kloss (1911). This series, excluding the specimen listed here, was later used by Chasen and Kloss (1929) as the basis of *G. v. perhentianus*, the type of which (F.M.S. 2321/10) is now 47.1428. The measurements of the type are recorded by Kloss (1911) under F.M.S. 2324/10; a different specimen is recorded under F.M.S. 2321/10.

#### *Galeopterus variegatus taylori* Thomas

Pulau Tioman, Pahang Archipelago: ♀ ♀ 55.1450–1451 Juara Bay. ♂ 55.1448, ♀ 55.1449.

Chasen and Kloss (1929), discussing this race, say that "in colour the females generally resemble *peninsulae*, but have the upper surface more buffy, especially on the occiput, neck and sides of the body". Three female specimens have the entire upper surface warm buff to ochraceous buff, coarsely streaked with black, especially on the membranes. One, 55.1449 has a narrow stripe of grey between the shoulders. The top of the head is olive buff. The male specimen is less rufous and more buffy than the immature type and is heavily mottled with black, especially on the membranes.

**Galeopterus variegatus terutau** Chasen and Kloss

Pulau Terutau, off west coast Peninsular Siam: ♂ 55.1442 Telok Wau, ♂ 55.1440-1441.

Three female specimens from Pulau Langkawi (9.11.1.10-12) are a lighter grey than are those from Terutau and are less conspicuously marked on the shoulders. According to Chasen and Kloss (1929) males from Langkawi are less rufous than those from Terutau.

**Pteropus hypomelanus geminorum** Miller

Pulau Paya, off Kedah: ♂ 55.1454.

Pulau Kuda, near Pulau Muntia, off west coast Peninsular Siam: ♂ 55.1455, ♀ 55.1456-1458.

The length of the forearm in four adults from Pulau Kuda measures 135-143 (139).

**Pteropus hypomelanus fretensis** Kloss

Pulau Jarak, Straits of Malacca: ♂ 55.1459, ♀ 55.1460.

Both specimens belong to the original series: the measurements of 55.1459 (F.M.S. 77/15) appear in the original description.

**Pteropus hypomelanus robinsoni** Andersen

Pulau Rumbia, Sembilan Islands: ♂ 55.1462, ♀ ♀ 55.1463-1465.

Pulau Lalaang, Sembilan Islands: ♂ 55.1461.

The length of the forearm in five adults from the Sembilan Islands measures 126-142 (137).

**Pteropus hypomelanus lepidus** Miller

Pulau Pemanggil, Johore Archipelago: ♂ 55.1466.

Pulau Tioman, Pahung Archipelago: ♂ ♂ 55.1467-1471 Juara Bay.

Pulau Aor, Johore Archipelago: ♂ ♂ 55.1473-1474.

Great Redang Island, off Kelantan: ♂ 55.1472.

West Perhentian Island, off Kelantan: ♂ 55.1475.

In nine adults from the islands off the east coast of the Malay Peninsula the length of the forearm measures 128-144 (135).

**Pteropus hypomelanus condorensis** Peters

Pulau Condor, off Cambodia, Cochin China: ♂ 55.1476.

**Pteropus vampyrus vampyrus** (Linnaeus)

East Java: ♂ 54.49 Badjoelmati, 100 ft.

**Pteropus vampyrus malaccensis** Andersen

Perak: 55.1477 Jor.

**Megaderma spasma medium Andersen**

Perak: ♂ 56.166 (skin only), ♀ 56.167 (skin only) Krian Road, Larut. ♀ 56.168-169 (skins only) Batu Tegor, near Taiping Hill. ♂ 56.170 (skin only) Temengoh, Selangor; ♂ 56.171 (skin only) Tanjung Karang, Pulau Terutau, off west coast Peninsular Siam; ♀ 56.172 (skin only) Sungai Udang.

**Rhinolophus affinis superans Andersen**

Selangor: ♂♂ 56.103-113 (skins only), ♀♀ 56.114-119 (skins only) Batu Caves, Kuala Lumpur.

Perak: ♂♂ 56.120-123 (skins only), ♀ 56.124 (skin only) Lenggong.

Great Redang Island: ♂ 56.125 (skin only)

Tioman Island: ♂ 56.126 (skin only) Juara Bay.

Chasen (1940) does not record *Rhinolophus affinis* from Great Redang Island or from Tioman Island. This series of skins represents both the rufous and the grey brown phases of the species. Specimens exhibiting the rufous phase are reddish brown above and below; the throat is broadly banded with paler hairs. Those in the drab phase are dark brown on the back; ventrally, the body is lighter and more greyish in colour while a wide band of light grey hairs extends across the throat.

Skins of *Rhinolophus affinis superans* are smaller than are those of the typical race from Java, Madura and Kangean Islands. Fifteen specimens of *superans* measure: head and body 51-67 (57), tail 19-27 (23), hindfoot 10-16 (11), ear 20-25 (22) and forearm (from dry skins) 48-51 (49). Of *affinis*: head and body 62-68 (66), tail 25-30 (27), hindfoot 10-12 (11), ear 21-24 (22) (thirteen specimens in all cases) and forearm (from dry skins) 50-54 (52) (fifteen specimens). Measurements of ♂ 56.125 (F.M.S. 2072/10) from Redang Island appear in Kloss (1911).

**Rhinolophus refulgens Andersen**

Pulau Pemanggil, Johore Archipelago: ♂ 56.128 (skin only).

Pulau Tioman, Pahang Archipelago: ♂♂ 56.129-130 (skins only), ♀ 56.131 (skin only) Juara Bay.

Chasen (1940) records this species from Pulau Tioman (Pahang) and Pulau Aor (Johore) and it might be expected that it would occur also on Pulau Pemanggil. Three specimens from Tioman agree closely in colour with the type. All are dark brown above and the pelage has a faint, silvery iridescent sheen. The underside is brownish; like the type, these specimens have many of the brown based hairs of the belly tipped with grey. 56.128 from Pemanggil is slightly paler dorsally and the dorsal fur is longer and softer than in the type or in specimens from Tioman. Ventrally, it is brownish with no grey tips to the hairs; the throat is banded with an indistinct patch of pale brown fur; in the type and in material from Tioman the throat is concolorous with the belly.

External measurements of three specimens from Pulau Tioman: head and body 36-40 (38), tail 14-19 (17), hindfoot 5-7 (6), ear 13-14 (14), forearm (from dry skins) 36-38 (37). Of one from Pulau Pemanggil: head and body 44, tail 23, hindfoot 7, ear 14 and forearm (from dry skin) 39.5.

**Rhinolophus minutillus Miller**

Pulau Aor, Johore Archipelago: ♀ 56.132 (skin only).

This skin agrees well with Miller's description of 'general colour broccoli-brown, the hairs everywhere with glossy pale tips, these most noticeable on the underparts. Ears

and membranes blackish brown.' The species is unrecorded from the Johore Archipelago by Chasen (1940). External measurements of an adult ♀ from Pulau Aor: head and body 40, tail 13, hindfoot 7.3, ear 12.5 and forearm (from dry skin) 37.

**Rhinolophus klossi Andersen**

Pulau Pemanggil, Johore Archipelago: 55.1479-1480 (skins only).

**Rhinolophus luctus maria Gray**

Perak: 56.127 (skin only) Taiping.

**Hipposideros armiger debilis Andersen**

Pulau Langkawi, off Perlis: ♂ 56.152 (skin only), ♀ 56.153-156 (skins only). 56.157-159 (skins only) Batu Puteh.

These specimens (forearm 87.0-92.5 (89.0)) agree closely in size with *debilis* from the mainland (forearm 85.0-92.5 (90.5)). They average darker on the back, membranes and wings than specimens from the mainland. External measurements of five specimens from Langkawi: head and body 88-96 (93), tail 54-67 (58), hindfoot 15-19 (16.5), ear 32-34 (33).

**Hipposideros diadema vicarius Andersen**

Perak: ♂ ♂ 56.133-140 (skins only) Lenggong.  
Selangor: ♀ 55.1478 Kuala Lumpur.

External measurements of nine specimens from Selangor and Perak: head and body 90-92 (91), tail 42-45 (43), hindfoot 14-16 (15), ear 27-32 (29) and forearm (from dry skins) 79-89 (85).

**Hipposideros pomona atrox Andersen**

Selangor: ♂ 56.162 (skin only) Semangko Pass, Selangor-Pahang boundary, 2,700 ft.

Pulau Terutau, off west coast Peninsular Siam: ♀ ♀ 56.163-165 (skins only) Telok Udang.

**Hipposideros larvatus neglectus Sody**

Pulau Butang, Butang Archipelago: ♂ ♂ 56.141-142 (skins only), ♀ ♀ 56.143-144 (skins only).

These specimens agree closely in colour with those from the adjacent mainland and are provisionally referred to *H. l. neglectus* Sody. However, they are smaller than this race and correspond more nearly in size with the typical race from Java. External measurements of four specimens from Pulau Butang: head and body 62-65 (63), tail 31-33 (32), hindfoot 9-10 (9.5), ear 19-22 (20) and forearm (from dry skins) 54-56 (55). Twenty-one specimens of *neglectus* from the Malay States give values for length of forearm (mainly from dry skins) of 57.5-61.0 (59.5) and thirty-one specimens of the typical race (mainly from dry skins) 54.5-61.5 (57.0). Chasen (1940) does not record *larvatus* from the Butang Islands, or from the Simalur Islands, whence there are specimens in the collection of the British Museum (Natural History).

**Hipposideros larvatus barbensis Miller**

Pulau Tioman, Pahang Archipelago: ♂ 56.145 (skin only) Juara Bay.

Pulau Aor, Johore Archipelago: ♂ ♂ 56.146-148 (skins only), ♀ ♀ 56.149-151 (skins only).

Chasen (1940) does not record *larvatus* from Pulau Aor. These specimens are provisionally identified with *barbensis* Miller, which is said to be smaller and duller in colour than mainland specimens. They agree with the description by Miller: dorsally they are a dull, dark brown on the posterior part of the back, greyish on the shoulders and wood-brown on the head. The underparts are a paler, wood-brown colour, tinged in some cases with grey; the ears and membranes are darker than in mainland specimens, which are a paler brown on the hindback with a straw-brown band on the shoulders and which have the head only slightly darker than this band. Ventrally, *neglectus* is a drab, yellowish brown colour. External measurements of seven specimens from Aor and Tionian: head and body 58–64 (60), tail 27–33 (29), hindfoot 9–10 (9), ear 19–23 (21) and forearm (from dry skins) 54–57 (55).

#### *Hipposideros galeritus galeritus* Cantor

Pulau Karimon, Riau Archipelago: ♂ ♂ 55.160–161 (skins only) Monos.

These specimens, together with three others from the same locality, are very slightly larger than the type specimen (the skull of which is of doubtful value (Tate (1941))). They average slightly darker on the posterior part of the back, while the head and shoulders are more greyish. Ventrally, these specimens are greyish brown and not wood-brown as is the type. Measurements of five specimens from Karimon: head and body 44–46 (45), tail 24–25 (24.5), hindfoot 6–7 (6.5) and ear 16–17 (16.5). The forearm (from dry skins) measures 47.0–48.0 (47.5) as against 46.5 in the type specimen.

#### *Hylobates syndactylus continentis* (Thomas)

Pahang: ♂ 55.1481 Gunong Tahan.

Negri Sembilan: ♂ 55.1482, ♀ 55.1483 Gunong Tampin.

Measurements of an adult male and (in parentheses) an adult female from Gunong Tampin: head and body 595 (580), hindfoot 178 (165), ear 35 (33), condylobasal length 96.1 (102.4), zygomatic width 86.3 (80.4) and upper toothrow with canine (alveoli) 36.8 (37.7).

#### *Hylobates agilis* Cuvier

Perak: ♂ 55.1484 Batu Tegor. ♂ 55.1485 Tea Gardens, Taiping. ♀ 55.1487 Maxwell's Hill, Taiping.

Dindings: ♀ 55.1486 Tanjong Hantu.

Measurements and descriptions of these specimens appear in Pocock (1927).

#### *Hylobates lar lar* (Linnæus)

Selangor: ♂ 55.1492 Rawang. ♂ ♂ 55.1488–1489 Bukit Cheraka, Jeram.

Negri Sembilan: ♂ 55.1490 Bukit Tangga. ♂ 55.1491 Gunong Anggsi. ♀ 55.1493 Gunong Tampin.

Of twelve specimens from localities south of the latitude of Penang one is buffy and one, although slightly buffy, is nearer to the dark phase, i.e. approximately 92 per cent of specimens examined are dark. Kloss (1929) found nineteen of twenty specimens from this area to be dark, i.e. 95 per cent. An example in buffy pelage, ♀ 6.10.4.2. from Kuala Teku, Tahan River, north Pahang, has the pale parts of the hands, feet and face slightly reduced and tends towards *entelloides*. A juvenile from the same locality shows the more usual dark phase.

*Hylobates lar entelloides* Geoffroy

Peninsular Siam: ♀ 55.1500 Tap-li (=Klong Wan), Pakchan, ♂ 55.1495 Nongkok, Grabi (=Krabi). ♂ ♂ 55.1496-1497, ♀ ♀ 55.1498-1499 Chong, Trang. ♂ 55.1494 Kao Nong, Bandon.

Of twenty three specimens from Tenasserim and Peninsular Siam south to Pakchan twelve are in the light phase i.e. approximately 48% of specimens examined are dark. Kloss (1929) found 45% of specimens from this area to be dark. There are no examples of the dark phase among ten specimens from Chong, Trang and Bandon, although one specimen is very slightly darker than the others. Kloss (1929) also found no examples of the dark phase among twelve specimens from this area.

*Hylobates moloch moloch* (Audebert)

West Java: ♂ 54.50 Tjibodas, Mount Gedeh, 4,500 ft.

*Hylobates moloch abbotti* Kloss

Sarawak: ♀ 55.706 Gunong Sidong, Samarahan, 1,200 ft.

This specimen is much more brownish than 33.6.6.1 from the Kapuas River. This latter specimen agrees well with the diagnosis of *abbotti* by Kloss in its rather lighter coloured fur, with a buffy tinge, and in its obsolescent dark cap.

*Hylobates moloch funereus* Geoffroy

Sarawak: ♂ ♂ 55.701-702, ♀ 55.703 Anyut, Sarebas. ♀ ♀ 55.704-705 Betong, Sarebas.

Although referred to this race, these specimens represent an intermediate stage between *abbotti* and *funereus*, which races appear to have a wide zone of intergradation in the region between the Sarebas Basin and the Baram River. 20.12.4.5 from Balinean exactly matches the specimen from the Kapuas River mentioned above while 55.702 from Anyut agrees perfectly with darkest *funereus*. Four other specimens from the Sarebas are in varying degrees intermediate between these extremes: the dark cap is obsolescent and is wood-brown in colour while the underside is brownish and in one specimen, 55.705, is black. Intermediates are also found in the Baram-Kalulong area, some 250 miles north-eastward: 91.8.28.2 is a brownish silver colour and has the obsolescent dark cap of *abbotti* while others, 91.8.28.1, 51.71 are similar to intermediates from Sarebas, but have a dark cap. Typical *funereus* also occurs in the same area, e.g. 51.73, 51.74, 90.1.28.1. Still further to the north-east, intermediates between *funereus* and *mulleri* can be found: one from Kinabalu has a yellow buffy dorsal area, black cap and feet and black on the inner side of the arms and the underside of the body.

In general, a series of this species from Sarawak confirms the view of Kloss (1929) that much of this territory has no distinctive gibbon: specimens very close to *abbotti* can be found in the extreme south-west and typical *funereus* in the north-east but over most of the area *Hylobates moloch* is represented by forms intermediate between these two races.

*Macaca speciosa melanota* (Ogilby)

Peninsular Siam: ♂ 55.1529 Hat Sanuk, near Koh Lak, Raiburi, ♂ 55.1530 Nongkok, Grabi (= Krabi). ♂ 55.1531 Lam-ra, Trang. ♂ 55.1532 (skull only). No locality.

Ellerman and Morrison-Scott (1951) use *melanota* for this race, which was listed by Chasen (1940) as *Macaca speciosa rufescens* Anderson.

**Macaca nemestrina nemestrina** (Linnaeus)

Sarawak: ♂ ♂ 55.707-708 Puto Paku, Betong, Sarebas. ♂ 55.709 Entawa, Samarahan.  
 Perak: ♂ 55.1501 Rungkup, Bagan Datoh.  
 Peninsular Siam: ♂ 55.1504 Chong, Trang.  
 Pahang: ♂ 55.1502 Beulong. ♂ 55.1503 Sungai Rengam.

**Macaca nemestrina leonina** Blyth

Peninsular Siam: ♂ 55.1505 Telok Poh, Pulau Panjang. ♀ 55.1506 Klong Tun Sai, Tongka, Junk Seylon.

**Macaca assamensis assamensis** M'Cllelland

Siam: ♀ 55.1507 Mc Puan, north-north-east of Lukon Lumpang, north Siam; 1,500-2,000 ft.

This specimen is that described by Kloss (1918). The tail has since been lost. It is paler on the back and has lighter brown arms than *assamensis* which is generally dark brown above. The species is not recorded from Siam by Ellerman and Morrison-Scott (1951).

**Macaca irus irus** Cuvier

Sarawak: ♂ 55.710 Entawa, Samarahan. ♂ 55.711. ♀ 55.712 Paku, Sarebas.  
 Pulau Pemanggil, Johore Archipelago: ♂ 55.1508.  
 Pulau Aor, Johore Archipelago: ♂ 55.1520.  
 Pulau Kabau, South China Sea: ♂ 55.1518.  
 Pulau Terutau, off west coast Peninsular Siam: ♂ 55.1509 Telok Wan.  
 Pulau Langkawi, off Perlis: ♂ 55.1519 Buraw.  
 Pulau Butang, Butang Islands: ♂ 55.1511.  
 Pulau Pintu Gedong, Klang Straits: ♂ 55.1517.  
 Penang Island: ♂ 55.1521 Telok Bahang.  
 Perak: ♂ 55.1510 Changkat Mentri.  
 Pahang: ♂ 55.1514 Tanjong Panjait, Rumpin.  
 Selangor: ♂ 55.1512 Weld's Hill, Kuala Lumpur. ♂ 55.1515 Gaik Liu Estate, Damansara. ♂ 55.1516 Bukit Cheraka, Jeram.  
 Singapore Island: ♂ 55.1513 Ponggol.

♂ 55.1508 from Pulau Pemanggil is provisionally referred to this race. The back and limbs are darker and greyer than in *M. i. irus* from the mainland and from other islands while the tail has its upper surface black throughout its length. Chasen (1940) notes that the species seems undifferentiated on the west coastal islands of the Malay Peninsula: on the east coast islands, however, macaques from Tioman and Tinggi are very bright in colour (*laeta*) while those from the Redang Islands (*argentimembris*) have greyer limbs than most examples from the mainland. ♂ 55.1520 from Pulau Aor closely resembles mainland material but has a slightly darker, browner tail.

**Macaca irus capitalis** (Elliot)

Koh Samui, off Bandon, Peninsular Siam: ♂ 55.1522.

**Macaca irus condorensis** Kloss

Pulau Condore, off Cambodia, Indochina: ♂ 55.1528.

**Macaca irus argentimembris** Kloss

Pulau Pinang, Great Redang Islands: ♂ 49.426 (the type specimen). ♀ 55.1523.

***Macaca irus laeta* (Elliot)**

Pulau Tioman, Pahang Archipelago; ♂ ♂ 55.1524–1525 Juara Bay, 55.1526 (skin only).

Pulau Tinggi, off east coast Johore: ♂ 55.1527.

***Macaca irus mordax* Thomas and Wroughton**

East Java: ♂ 54.51 Tamansari, 1,600 ft.

***Presbytis melalophos femoralis* (Martin)**

Singapore Island: ♂ 55.1564 Changi.

***Presbytis melalophos australis* Miller**

Johore: ♂ ♂ 55.1566 (skin only), 55.1565 Padang Tuan Segamat.

Although Pocock (1935) thought that *australis* might be synonymous with *femoralis* it seems best retained as an intermediate race between *femoralis* and *siamensis*, distinguished from *femoralis* by its whiter underparts and from *siamensis* and *nubigena* by its darker back. 55.1565 from Segamat has the back and thighs black; 55.1566 from the same locality has greyish thighs and the back browner: this specimen tends towards *siamensis*.

***Presbytis melalophos siamensis* (Müller and Schlegel)**

Perak: ♀ ♀ 55.1572–1574 Changkat Mentri.

Pahang: ♀ 55.1571 Kuala Tembeling, Pahang River, 200 ft.

Selangor: ♂ ♂ 55.1568, 55.1567 (skin only) Ulu Gombok. ♂ ♂ 55.1569–1570 Ginting Bidai. ♂ 55.1575 Gunong Mengkuang Lebar, 4,800 ft. ♀ 55.1576 Bukit Cheraka, Jeram. ♂ 55.1577 Dusun Tua.

Intermediates with *nubigena* (Malacca, Negri Sembilan) occur in Selangor: there are specimens with greyish thighs from Gunong Mengkuang (another from this locality has white thighs); Cheras: Ulu Gombok and Ginting Bidai.

***Presbytis melalophos nubigena* Elliot**

Malacca: ♂ 55.1579 (skull only) Nyalas.

***Presbytis melalophos robinsoni* Thomas**

Peninsular Siam: ♂ 55.1580 Khao Luang, Naken Sri Tamarat, 2,000 ft. ♂ 55.1581 Tasan, Chumpawn, 220 ft. ♂ ♂ 55.1582, 55.1583, ♀ 55.1589 Khao Nong, Bandon, 1,200–1,500 ft. ♂ 55.1583, ♀ 55.1584 Klong Tun Sai, Tongka, Junk Seylon. ♀ 55.1585 Chong, Trang.

Perlis: ♀ 55.1586 Pelarit.

Perak: ♂ 55.1587 Me Kuning, Taiping.

This race extends at least as far south as Ulu Ijok and the Larut Hills, Perak. Two specimens from Tongka, Junk Seylon and one from Trang have the back a pale sepia brown; 55.1588 from Bandon is a cream white mutant of this race.

***Presbytis melalophos chrysomelas* (Müller)**

Sarawak: ♀ ♀ 55.721–722 Balingean. ♂ ♂ 55.719–720 Betong, Sarebas. ♀ ♀ 55.723–724 Mora Barue, Samarahan. ♀ 55.725 Samarahan.

*P. m. cruciger* (Thomas), of which 55.719 and 55.720 are examples, appears to be an erythristic mutant of *chrysomelas*. For views on this see Banks (1930), Chasen and Kloss (1931) and Pocock (1935).

*Presbytis aygula aygula* (Linnaeus)

West Java: ♂ 54.52, ♀ 54.53 Tjibodas, Mount Gedeh, 4,500–5,000 ft. ♂ ♂ 54.54–  
55 Wynkoops Bay, 100 ft.

*Presbytis aygula hosei* (Thomas)

Sarawak: ♂ 55.713 Longhenin, Tinjar River.

*Presbytis potenziani siberu* (Chasen and Kloss)

Mentawi Islands, West Sumatra: ♂ 28.11.2.1 (the type specimen), Siberut Island.

*Presbytis obscurus obscurus* (Reid)

Perlis: ♂ 55.1542 Pelarit.

Kedah: ♀ 55.1543 Gurun.

Dindings: ♂ 55.1540, ♂ 55.1541 Tanjong Hantu.

Selangor: ♂ ♂ 55.1533–1534 Semangko Pass, Selangor-Pahang boundary, 2,700

ft.; ♂ 55.1535 Ginting Bidai.

Malacca: ♀ ♀ 55.1538–1539 Nyukis.

Johore: ♂ 55.1536 Padang Tuan Segamat, ♂ 55.1537 Si Karang, ♀ 55.1544  
(skull only) Tebrau.

Skins from Perlis and Kedah are darker on the back, arms and tail than are those from more southerly localities and approach the rather darker *halonifer*.

*Presbytis obscurus flavicauda* (Elliot)

Peninsular Siam: ♂ 55.1545 Tasan, Chuimpawn, 220 ft. ♂ 55.1546 Ban Kok

Klap, Bandon, 50 ft. ♂ 55.1547 Nongkok, Grabi (=Krabi), ♀ 55.1548 Chong, Trang.  
55.1546 is a pale mutant of this race and is described by Robinson and Kloss

(1915), Pocock (1935) and mentioned by Chasen (1940).

*Presbytis obscurus halonifer* (Canfor)

Penang Island: ♂ 55.1549 Pantai Kerchut. ♂ ♂ 55.1550–1551, ♀ 55.1552 Telok

Bahang.

Pulau Langkawi, off Perlis, Malay States: ♀ ♀ 55.1553–1554.

Chasen (1935), (1940) referred specimens from Langkawi to *carbo*. Three specimens from this island are nearer to *halonifer* in their brownish dorsal colour, which has a faint bronze sheen, and their paler forearms, than to *carbo*.

*Presbytis obscurus carbo* Thomas and Wroughton

Pulau Terutau, off west coast Peninsular Siam: ♂ 55.1555.

Three specimens (including the type) in the British Museum (Natural History) are darker and blacker on the back than material from Langkawi, referred here to *halonifer*. Specimens from Terutau are black and not brownish on the forearms, and have no trace of a bronze sheen on the back.

*Presbytis obscurus styx* Kloss

East Perhentian Island, off Kelantan: ♂ 49.424 (the type specimen). ♂ 55.1560.

*Presbytis obscurus seimundi* (Chasen)

Koh Peuman, off Bandon, Peninsular Siam: ♂ ♂ 55.1556–1558, ♀ 55.1559.

***Presbytis obscurus* subsp.**

Pulau Panjang, off west coast Peninsular Siam; ♂ 55.1561 (skull labelled 277; the correct collector's number is 305).

This specimen, which may be abnormal, is fully described by Pocock (1935). It should perhaps be referred to *flavicauda*.

***Presbytis rubicundus rubidus* (Lyon)**

Sarawak: ♂ ♂ 55.726-728, ♀ 55.729 Paku, Sarebas.

These specimens are slightly darker than material from north-eastern Sarawak (*ignitus*) from which this race seems only weakly separable. The two races intergrade in the Baram area.

***Presbytis rubicundus ignitus* Dollman**

Sarawak: ♂ 55.730 Mount Dulit, Baram, 3,400 ft.

***Presbytis frontatus nudifrons* Elliot**

Sarawak: ♀ 55.714, No precise locality.

***Presbytis cristatus pyrrhus* (Horsfield)**

East Java: ♂ 54.56 Ongop Ongop, Idjen Massif, near Banjoewangie, 5,700 ft. ♂ ♂ 54.57-58, ♀ 54.59 Sodong Jerok, Idjen Massif, 3,900 ft. ♂ 54.60 Tamansari, East Java, 1,600 ft. ♂ 54.61 Badjoelmati, 100 ft.

***Presbytis cristatus sondaicus* (Robinson and Kloss)**

West Java: ♂ 49.423 (the type specimen), ♂ 54.62 Tjibodas, Mount Gedeh, 5,000 ft.

***Presbytis cristatus ultimus* (Elliot)**

Sarawak: ♀ 55.717 Entawa, Samarahan, ♀ 55.718 Sungai Pelundok, Paku, Sarebas. 55.715-716, No data.

Selangor: ♂ 55.1562, ♀ 55.1563 Kuala Selangor.

The extensive 'lumping' of this species practised by Pocock (1935) seems unjustified: a good series in the collection of the British Museum (Natural History) agrees closely with the conclusions of Chasen (1940). The series available includes specimens from the greater part of the range of *P. cristatus* and shows that in general the species in Malaysia becomes paler in colour in a south-north direction: this trend is modified in Java where increase of silvery colour is apparent in a west-east direction. *P. c. sondaicus*, an almost jet black form, is confined to the west (rainfall greater than 120 inches per annum) region in the extreme west of Java: at about the latitude of Tjilatjap and Karangbolang it is replaced by the more spangled, paler coloured *P. c. pyrrhus*, which extends throughout the more arid region of east Java. This trend culminates in *P. c. kohlbruggei* (synonym *stresemanni*) from Bali, a yet paler form. In south Sumatra, *P. c. cristatus*, a brownish black form with little silver spangling, is replaced in the north of the island by animals which are referable to *P. c. ultimus*, a paler, more silvery race occurring also in the Malay States and in Borneo. A single specimen from south Borneo, although slightly darker than typical *ultimus* from Sarawak, can be referred to this race. *P. c. pullata* from Batam Island, Riau Archipelago, was synonymised with *cristatus* by Pocock (1935) and Chasen (1940). However, it should be retained as a race intermediate between *cristatus* and *ultimus*: in general, most specimens are darker

on the back and have darker tails than *ultimus* but are more silvered on the back than is *cristata*. No doubt similar animals occur on the eastern coastal islands of Sumatra opposite the Rhio Archipelago.

***Simias concolor siberu* Chasen and Kloss**

Mentawi Islands, West Sumatra: ♂ 28.11.2.2 (the type specimen), Siberut Island.

***Tarsius bancanus borneanus* Elliot**

Sarawak: ♂ 55.731, ♀ 55.732 Sungai Pelandok, Paku, Sarebas, ♀ 55.733 Anyut, Paku, Sarebas.

The upperparts of a young female, 55.732, are dark grey; in the adult they are olive buff. Cranial measurements of an adult male and (in parentheses) and adult female: greatest length of skull 39.6 (38.6), orbital width 34.5 (33.8), braincase width 23.0 (22.4) and maxillary toothrow 12.4 (12.2).

***Nycticebus coucang coucang* (Boddaert)**

Perak: ♂ ♂ 55.1609, 55.1611 Kuala Kangsar, 55.1610 Bukit Gantang.

Penang Island: ♀ 55.1594 Telok Bahang.

Dindings: ♀ 55.1591 Pulau Pangkor.

Selangor: ♀ 55.1590 Ulu Gombok, 1,600 ft.

***Helarctos malayanus euryspilus* Horsfield**

Sarawak: 55.734 (skull only). No data.

***Martes flavigula peninsularis* Bonhote**

Peninsular Siam: ♀ 55.1641 Nongkok, Grabi (=Krabi), ♀ 55.1642 Trang.

Perak: ♀ 55.1640 Gunong Kerbau, 5,000 ft.

Trengganu: ♀ 55.1639 Bukit Jong.

***Martes flavigula indochinensis* Kloss**

Peninsular Siam: ♀ 55.1643 Koh Lak, Raiburi.

This race extends into Peninsular Siam on the eastern side of the Malay Peninsula: *peninsularis* extends into Tenasserim on the western coast. Koh Lak is apparently the most southerly record for *indochinensis*.

***Martes flavigula saba* Chasen and Kloss**

Sarawak: ♂ 55.735 Ulu Paku, Sarebas, ♀ 55.737 Anyut, Paku, Sarebas, ♀ 55.736 Mount Dilit, Baram.

***Mustela nudipes* Cuvier**

1821 *Mustela nudipes* F. Cuvier, in E. Geoffroy, S.H. and F. Cuvier, *Hist. Nat. Mamm.*, 2, (32), Furet de Java, Z. West Sumatra (Robinson and Kloss (1919)).

1865 *Gymnopus leucocephalus* Gray, *Proc. Zool. Soc. Lond.*, 119. "Sumatra and Borneo".

Sarawak: ♂ 55.739 Entawa, Samarahan, ♂ 55.738 Anyut, Paku, Sarebas, ♀ 55.740 Sungai Pelandok, Paku, Sarebas.

Peninsular Siam: ♀ 55.1595 Chong, Trang.

Chasen and Kloss (1931) and Chasen (1940) regarded Bornean and Malayan weasels as racially distinct from those of Sumatra since in the series before them the tails of Sumatran animals were tipped with white while those from Borneo and Malaya had much less particoloured or almost concolorous tails. The series in the British Museum

(Natural History) consists of thirteen specimens, of which four are from Sumatra, five from Malaya and four from Borneo. There are also three specimens of uncertain locality. This series suggests that the tail character is unreliable and is of no subspecific value. No whitish tails appear in the specimens from Sumatra: dorsally these specimens vary in colour from ochraceous orange to cinnamon. 25.9.10.4 from Fort de Knok has a unicolourous tail; a darker specimen, 26.3.12.1 from Lebong, has the tail tipped for the terminal third with ochraceous orange, contrasting with its darker back. This specimen has an ochraceous orange vertebral streak between the shoulders. Material from Malaya shows the same gradation in colour as does that from Sumatra: the terminal third of the tail is lighter in colour than the rest of the body in 85.8.1.68 from Selangor and in 71.4.10.1 from Malacca, while traces of a vertebral stripe appear in the former specimen. Bornean material shows the same colour variation: two specimens, 55.738 and 55.740 from the Sarebas, have a vertebral stripe while 99.12.9.28 from Baram and 55.738 from the Sarebas have the terminal third of the tail lighter in colour than the head and body. On the series available there seems no basis upon which to separate Bornean, Malayan and Sumatran *Mustela*: although considerable variation in colour occurs it is the same among specimens from each island and is perhaps due to the seasonal condition of the pelage. The lighter coloured tail tip in some specimens may be correlated with the same cause.

### *Gymnopus leucocephalus* Gray

This name was used by Chasen and Kloss (1931) and by Chasen (1940) for Bornean and Malayan weasels. Gray's citation reads:

*Gymnopus leucocephalus*

Golden fulvous, nearly uniform, scarcely paler beneath; head white; toes elongate, webbed, nakedish.

*Putorius nudipes* F. Cuv. Mamm. Lith.

*Mustela nudipes* Desm. Mamm.; Müller, Verhand.; Gerrard, Cat. Mamm. B.M. 94; Blainville, Ostéogr.t.13 (teeth).

*Var.* End of tail paler; feet darker, front of the back with a pale vertebral streak, wider and more distinct between the shoulders.

*Hab.* Sumatra and Borneo.

Examination of other synonymies for other species listed in Gray's paper show that Gray intended the synonymy quoted above to refer to *leucocephalus* with which he apparently intended to replace *nudipes*: *leucocephalus* is therefore a synonym of *nudipes* and since the type locality of *nudipes* has been fixed on Sumatra (Robinson and Kloss (1919)) it cannot be available for Bornean or Malayan animals if it is thought necessary to separate them from those of Sumatra. His *Var.* Gray has left unnamed.

At the time that Gray prepared his paper there were two specimens of this weasel in the collection of the British Museum (Natural History). One, 55.12.24.217 (skull 58.5.4.86) of indeterminate locality, is apparently that described as *leucocephalus*; the other, 46.3.5.4 agrees with Gray's *Var.* in that the end of the tail is paler, the feet are darker and a vertebral streak is present. The skulls agree with the measurements cited by Gray. "*Hab.* Sumatra and Borneo" refers to *leucocephalus* and not to Gray's '*Var.*' alone as thought by Chasen and Kloss (1931). 46.3.5.4 is labelled Java, but as shown by Robinson and Kloss (1919) material collected in Sumatra during the early and middle part of the nineteenth century was often shipped to Europe from Java and was not infrequently thought to have originated in that country. Gray has, in fact, described two phases of *nudipes* which have been shown above to occur in Sumatra, Borneo and Malaya.

*Lutrogale perspicillata* (Geoffroy)

Perak: ♂ 55.1596 Port Weld, Larut.  
 Pahang: ♂ 55.1597 Kampong Padang, Tembeling.

*Cyon javanicus sumatrensis* (Hardwicke)

Perak: ♂ 55.1600 Bukit Gantang, Larut.  
 Pahang: ♂ 55.1601 Kuala Tembeling.

*Amblyonyx cinerea* (Illiger)

Perak: ♂ 55.1599 Taiping.  
 Selangor: ♂ 55.1598 Kuala Lumpur.

*Prionodon linsang linsang* (Hardwicke)

Perak: ♀ 55.1602 Taiping.

*Viverra zibetha pruinosus* Wroughton

Peninsular Siam: ♀ 49.436 (the type specimen of *Viverra zibetha sigillata* Robinson and Kloss), Bang Nara, Patani.

Perlis: ♀ 55.1603 Pelarit.

Perak: ♂ 55.1604 Temengoh.

Selangor: ♂ 55.1605 Kuala Lumpur.

The type and three specimens from the original series of *V. z. sigillata* Robinson and Kloss.

*Viverra tangalunga tangalunga* Gray

Sarawak: ♀ 55.741 Sungai Pelandok, Paku, Sarebas.

*Viverra tangalunga lancavensis* Robinson and Kloss

Pulau Langkawi, off Perlis: ♀ 49.437 (the type specimen), Batu Puteh.

*Viverricula malaccensis malaccensis* (Gmelin)

Perak: ♂ 55.1606 Krian Road, Taiping.

*Paradoxurus hermaphroditus musanga* (Raffles)

Perak: ♂ ♂ 55.1609, 55.1611 Kuala Kangsar, 55.1610 Bukit Ganting.

Selangor: ♂ 55.1607 Sungai Wae, Kuala Lumpur, ♀ 55.1608 Dengkil, Kejung.

This race extends as far north as Perak and Pahang (Telom River); no specimens from Kelantan are available in the collection of the British Museum (Natural History).

*Paradoxurus hermaphroditus cantor* Pocock

Penang Island: ♀ 55.1612 Telok Bahang.

*Paradoxurus hermaphroditus minor* Bonhote

Perak: ♂ 55.1613 Mengkuang.

Perlis: ♂ 55.1614 Pelarit.

Pulau Lontar, off west coast Peninsular Siam, ♀ 55.1615 Pasir Raja.

Pulau Panjang, off west coast Peninsular Siam: ♂ 55.1617 Telok Poh.

Junk Ceylon, off west coast Peninsular Siam: ♂ 55.1616 Klong Tun Sai, Tongka.

Peninsular Siam: ♀ 55.1618 Tasan, Chumpawn (immature, listed by Pocock (1934) as *laotum*), ♀ 55.1619 Hat Sanuk, near Koh Lak, Raiburi (immature, listed by Pocock (1934) as *laotum*).

Koh Pennan, off Bandon, Peninsular Siam: ♀ 55.1620.

*Paradoxurus minor* Bonhote was treated by Pocock (1934) as a subspecies of *P. hermaphroditus* occurring in various localities from Annam to Selangor alongside other races of *P. hermaphroditus*. It seems better to follow the example of Chasen (1940) who used the name (with synonym *Paradoxurus rarus* Miller) for the smaller paler (when compared with *nusanga*) palm civets from the north of the Malay Peninsula, and who suggested that *minor* had no real existence in the sense that Pocock employed the name. Buffy animals (i.e. similar to *minor*) in the collection of the British Museum (Natural History) are generally young adults: Chasen (1940) points out that such animals are in some cases abnormal. The type of *minor* is a young adult.

There appears to be no essential difference between *minor* and *P. h. cochineum* Schwarz (*Ann. Mag. Nat. Hist.*, 1911, 7: 635. Saigon, Cochin China). The reddish brown tail, limbs and headband of the type of *cochinenis* can be matched by specimens from Pulau Panjang and Koh Pennan; in other specimens these areas are black. Animals larger than those from further north but there is no appreciable difference in colour or pattern. This race intergrades with *P. h. laotum* in southern Tenasserim. For measurements of adults in the collection of the British Museum (Natural History) see Pocock (1935).

***Paradoxurus hermaphroditus canus* Miller**

Pulau Terutau, off west coast Peninsular Siam: ♂ ♂ 55.1621–1622. Telok Wau. ✓ 55.1623.

***Paradoxurus hermaphroditus philippinensis* Jourdan**

Sarawak: ♂ 55.742 Mount Dulit, Baram.

***Paradoxurus hermaphroditus* subsp.**

Pulau Langkawi, off Perlis: ♂ 55.1624 Telok Apau. ♂ 55.1625 Sungai Kilim.

For a description of these and of another specimen from Langkawi see Pocock (1935).

***Paguma larvata robusta* (Miller)**

Peninsular Siam: ♂ 55.1626 Ongut, Trang. ♂ 55.1628 Ban Kok Klap, Bandon, 50 ft. ♀ 55.1627 Khao Luong, Nakon Sri Tamarat.

***Paguma larvata jourdani* (Gray)**

Perak: ♂ 49.438 (the type specimen of *Paguma larvata annexans* Robinson and Kloss). Bukit Gantang.

***Paguma larvata ogilbyi* (Fraser)**

Sarawak: ♀ ♀ 55.743–744 Mount Dulit, Baram, 3,500 ft.

***Arctictis binturong binturong* (Raffles)**

55.1629 (skull only). No data.

***Arctictis binturong penicillatus* Temminck**

Sarawak: ♀ 55.745 Mount Dulit, Baram, 3,400 ft. ♀ 55.746 Anyut, Sarebas.

*Arctogalidia trivirgata sumatrana* Lyon

Perak: ♂ 55.1632 Pondok Tanjong.  
 Pahang: ♂ 55.1630 Kuala Teku, Tahan.  
 Selangor: ♂ 55.1631 Kuala Lumpur.  
 Singapore Island: ♂ 55.1633 Bukit Timah.

*Arctogalidia trivirgata macra* Miller

Pulau Terutau, off west coast Peninsular Siam: 55.1634 Telok Wau.

*Arctogalidia trivirgata leucotis* (Horsfield)

Peninsular Siam: ♂ 55.1635 Hat Sanuk, near Koh Lak, Raiburi.

*Arctogalidia trivirgata stigmatica* (Temminck)

Sarawak: ♀ 55.747 Anyut, Paku, Sarawas. ♂ 55.749 Longheniu, Tinjar River.  
 55.748, no data.

*Hemigalus derbyanus derbyanus* (Gray)

Pahang: ♂ 55.1636 Kuala Tahan.

*Herpestes brachyurus brachyurus* Gray

Selangor: ♂ 55.1637 Bukit Tanjong.

*Herpestes brachyurus rajah* Thomas

Sarawak: ♂ 55.750 Entawa, Samarahan.

*Herpestes javanicus peninsulae* (Schwarz)

Perak: ♂ 55.1638 (skull only) Taiping.

*Felis nebulosa diardi* Cuvier

Peninsular Siam: ♂ 55.1644 Tasan, Chumpawn.

*Felis marmorata marmorata* Martin

Perak (?): ♂ 55.1645 Batu Tigor.

*Manis javanica* Desmarest

Peninsular Siam: ♀ 55.3260 Tap-li (=Klong Wan), Pakchan.

*Lepus siamensis* Bonhote

Peninsular Siam: ♂ 55.1646, ♀ 55.1647 Koh Lak, Raiburi.

*Petaurista petaurista nigricaudatus* Robinson and Kloss

East Java: ♂ 49.432 (the type specimen). Ongop Ongop, Idjen Massif, near Banjoewangie, 5,700 ft.

*Petaurista petaurista cicur* Robinson and Kloss

Peninsular Siam: ♂ ♂ 49.431 (the type specimen), 55.1648 Ban Kok Klap, Bandon.

This race differs from the more southerly *melanotus* in its chestnut and not bay dorsal pelage and in having a large proportion of the hairs on the back tipped with black. In addition to the characters noted by Robinson and Kloss, the ear tuft in *cicur* is composed mainly of black hairs, while in *melanotus* it is composed mainly of chestnut hairs.

**Petaurista petaurista melanotus (Gray)**

Peninsular Siam: ♂ 55.1649 Ko-khau, Trang.  
Selangor: ♂ 55.1650 Ulu Gombok.

Pulau Tioman, Pahang Archipelago: ♂ 55.1651 (skin only), ♀ 55.1652 Juara Bay. Chasen (1940) records this race from as far north as Patani. Two specimens from Trang and one from Salanga Island (= Junk Sylon) are referable to *melanotus* and extend its range on the west coast of the Peninsula to at least 8° N. Chasen (1940), who had examined only two specimens, thought that material from Pulau Tioman might prove separable from mainland material on grounds of brighter, paler colour. There is no appreciable difference in colour between four specimens from that island and a good series from the mainland.

**Petaurista petaurista penangensis Robinson and Kloss**

Penang Island: ♀ 49.433 (the type specimen), ♂ 55.1653 Telok Bahang.

**Petaurista petaurista terutaus Lyon**

Pulau Terutau, off west coast Peninsular Siam: ♂ 55.1654, ♀ 55.1655 Telok Wau. Two of the specimens described by Robinson and Kloss (1918).

**Petaurista petaurista taylori Thomas**

1914 *Petaurista taylori* Thomas, J. Bamb. Nat. Hist. Soc., 23, 2: 205. Bankachon, southern Tenasserim.

Peninsular Siam: ♂ ♂ 55.1656, 55.1657 Hat Sanuk, Koh Lak, Raiburi.

I am unable to agree with Ellerman (1947) (1949) or with Ellerman and Morrison-Scott (1951) that *Petaurista taylori* Thomas is a synonym of *Petaurista alborefus canidulus* Wroughton or that *taylori* should be referred to the species *alborefus*. Hitherto, the only specimen of *taylori* available in the British Museum (Natural History) was the type, an imperfect flat skin without skull. In this specimen the hairs of the muzzle are grey based and are profusely tipped with greyish white, those on the crown dark grey at the base, annulated with chestnut and much less profusely tipped with white. The general colour of the back is rich rufous with white speckling confined to a small patch on the withers and rump. There is no dark saddlepatch and the middle of the neck and back (the specimen is in moult) is not darker than and not contrasted with the sides, shoulders or gliding membrane. At the base and for its basal third the tail is ferruginous, the hairs with black tips while the tip of the tail is black and the intervening portion greyish. The gliding membrane is edged with black where it adjoins the forelimbs and with dark brown on the edges adjacent to the hindlimbs; the central parts of the edge are grey. The ears have their anterior edge white and their posterior edge black. A prominent black ear tuft is present.

55.1656 from Koh Lak closely resembles the type, but is much more profusely speckled with white on the back, nape and top of the head. The cheeks and throat are grey. The underparts are white with a buffy tinge intensifying towards the hind limbs. Dorsally, the root of the tail is the same colour as the back; ventrally, it is orange buff. In its central portion the tail is greyish above and below, with an ochraceous buff tinge. The tail is black for its terminal two inches. Limbs on their outer surfaces are the same colour as the back and are black on their inner surfaces. The upper surface of the feet is black. The gliding membrane at its edges exactly resembles that of the type. A second specimen from the same locality is rather darker dorsally and is more heavily speckled with silver while its underparts are white with no buffy or ochraceous tinge. Prominent black ear tufts are present in both specimens.

*Petaurista alborufus candidulus* (fifteen adults examined) is much more profusely speckled with white on the back than is *taylori*, lacks prominent black ear tufts and has the limbs on their inner surfaces rufous, the same colour as the dorsal surface of the gliding membrane or only very slightly darker, not black or dark brown as in *taylori*. In referring this race to the synonymy of *candidulus* and thus to the species *alborufus* Ellerman appears to have been misled by the restricted speckling on the head of the type which gives the appearance of the white headband characteristic of *alborufus*, by the difficulty of forming an estimate of the total white dorsal speckling of the type through the moult condition of the skin and by the fact that the type skin is imperfect, having lost the feet and much of the legs.

Measurements of two adult males from Koh Lak (55.1667 in parentheses): head and body 448 (448), tail 550 (555), hindfoot 80 (81), ear 42 (43), greatest length of skull 74.6 (72.6), condylobasal length 70.8 (69.2), palatal length 38.9 (37.9), diastema 16.6 (16.0), maxillary toothrow 17.5 (17.4) and zygomatic width 51.0 (—).

Fairly well marked trends in coloration can be seen in *Petaurista petaurista* from south-east Asia. Drab, grey tailed forms, *merguli*, *reguli* and *primrosei*, with little dorsal silvering and with the back greyish or olivaceous (*mergulus*, *reguli*) or dull ferruginous (*primrosei*) occur in the Mergui Archipelago. These, together with the grey tailed, drab but more heavily silvered *cinerrea* from northern Tenasserim, and southern Burma and a similar but brighter form, *philippensis*, from eastern India, are linked to the brightly coloured races of Siam, Upper Burma and Annam by *taylori*, which although retaining the grey tail, is brightly rufous on the back and is more heavily silvered than the western races. Eastward, in Annam, Tonkin, Laos and Cochin China, *badiatus* and *annamensis* are much more silvered than *taylori* and have the tail black for much of its length. *P. p. lylei*, from northern Siam, is rather more silvered than *badiatus* but is less brightly ferruginous (Ellerman and Morrison-Scott (1951) thought that these races might be synonymous) while similar forms, *yunnanensis* and *albiventer*, occur over most of Burma, Yunnan and north-eastern India. *P. p. stockleyi* (not seen) from north-west Siam appears to be a greyer form than *lylei* and seems to tend towards *cinerrea*. Generally, outside the Malay Peninsula, the intensity of rufous colour on the back in this species increases in an eastward direction, while the extent of white or silver speckling on the back decreases in a southerly direction until south of the Isthmus of Kra only brightly rufous races with no trace of speckling are found.

#### *Iomys horsfieldii penangensis* Chasen

Penang Island: ♂ 55.2428, ♀ 55.2429–2430 Telok Bahang.

These specimens were collected at the same time as the series described by Chasen and their measurements correspond closely to those of the type: head and body 174–187 (181), tail 175–200 (185), hindfoot 34–36 (35), ear 24–26 (25), greatest length of skull 44.8–45.2 (45.0), condylobasal length 41.9–42.5 (42.2), zygomatic width 27.3–27.8 (27.5) and maxillary toothrow 9.1–10.0 (9.5).

#### *Hylopetes spadiceus spadiceus* (Blyth)

Tenasserim: ♂ 55.2431 Banlaw, Great Tenasserim River.

Negri Sembilan: ♀ 55.2432 (skin only) Bukit Tangga.

Chasen (1940) considered that two forms of *Hylopetes* exist side by side in the Malay Peninsula. The larger, to which he applied the name *spadiceus*, he referred to the species *sagitta* (now called *lepidus* since *Sciurus sagitta* Linnaeus is apparently a *Petromys* (Ellerman and Morrison-Scott (1955))), together with a number of other races from the adjacent islands. The smaller he referred to *platyrurus* Jentink, which he thought

to be a monotypic species occurring only in Sumatra and the Malay States. Ellerman (1949) and Ellerman and Morrison-Scott (1951) (1955) do not accept this view and suggest that *spadiceus* should be raised to specific rank on account of its proportionately larger bullae and that *platyrurus* is in fact a race of *lepidus*. Ellerman and Morrison-Scott (1951) refer *Hylopetes* from Tenasserim to *Hylopetes lepidus belone* Thomas (Pulau Terutau).

These specimens and other accessions to the collection of the British Museum (Natural History) confirm the view of Chasen (1940) that two forms of *Hylopetes* exist in the Malay Peninsula. A good series of the larger form from the Malay States, Tenasserim and Indochina cannot be distinguished from a cotype of *spadiceus* (the skin of which is in poor condition). Nine skulls (except where stated), including the cotype, measure condylobasal length (eight specimens) 29.9–34.3 (31.8), maxillary toothrow 6.7–7.9 (7.3), length of bulla 9.5–10.5 (9.9) and breadth of bulla 7.4–8.1 (7.8). These specimens cannot be separated from *belone* (Pulau Terutau) on size but may be distinguished from it by their deeper, darker, more blackish dorsal colour. Four skulls of *belone* measure: condylobasal length 32.0–32.8 (32.4), maxillary toothrow 6.8–7.3 (7.1), length of bulla 9.7–9.9 (9.8) and breadth of bulla 7.4–8.2 (8.0). External measurements of *spadiceus*: head and body 126–165 (140), tail 100–135 (123) (twelve skins in both instances); of *belone*: head and body 138–153 (145), tail 115–138 (129) (four skins in both instances).

The smaller form, of which only one is available from the Malay States, while the others are from Sumatra, has cranial measurements (four skulls) of: condylobasal length 26.9–32.3 (29.3), maxillary toothrow 5.8–7.2 (6.5), length of bulla 8.6–9.2 (8.9) and breadth of bulla 6.7–7.4 (7.1). These specimens agree with the description of *platyrurus* by Jentink.

Of other Malaysian races in the collection of the British Museum (Natural History), *harrisoni* (Borneo) gives cranial measurements (four skulls) of: condylobasal length 32.7–36.4 (34.6), maxillary toothrow 7.5–8.4 (8.0), length of bulla 9.8–10.9 (10.5) and breadth of bulla 7.8–8.7 (8.4), while the skull of the type of *everetti* (Natunas) measures: condylobasal length 36.4, maxillary toothrow 8.4, length of bulla 11.2 and breadth of bulla 8.8. From Sipora Island, off the coast of Sumatra, *sipora* measures: condylobasal length 35.0, maxillary toothrow 7.3, length of bulla 10.0 and breadth of bulla 8.7. From Java, *lepidus* give cranial measurements (four skulls) of: condylobasal length 31.0–35.5 (33.2), maxillary toothrow 7.1–7.6 (7.3), length of bulla 8.8–9.5 (9.1) and breadth of bulla 7.6–7.8 (7.7), while from the nearby island of Banka the type of *aurantiacus* measures: condylobasal length 31.8, maxillary toothrow 7.3, length of bulla 8.8 and breadth of bulla 7.4.

The small amount of material available indicates that, as suggested by Ellerman, *spadiceus* should be retained as a species, distinguished by its proportionately large bullae, ranging through the Malay Peninsula and Indochina north at least to Arakan. Forms with large bullae which should be associated with it are *belone*, *harrisoni*, *everetti*, *sipora* and probably *annae* from Pulau Kundur, which I have not seen but which appears from the description to be a large form close to *spadiceus*. A smaller species, with proportionately smaller bullae, *platyrurus*, occurs in Sumatra and the Malay States. With it should be associated *lepidus* from Java, a form with slightly larger bullae, and *aurantiacus* from the island of Banka. The valid species and races would be:

#### *Hylopetes spadiceus spadiceus* (Blyth)

1847 *Sciuropterus spadiceus* Blyth, Journ. Asiatic Soc. Bengal, 16: 867. Arakan.  
Range: Burmo, Indochina, Annam, Tenasserim, Malay States.

***Hylopetes spadiceus everetti* (Thomas)**

1895 *Scluropterus everetti* Thomas, *Nat. Zool.*, 27, Bunguran Island.  
Range: Bunguran Island, North Natuna Islands.

***Hylopetes spadiceus harrisoni* (Stone)**

1900 *Scluropterus harrisoni* Stone, *Proc. Acad. Sci. Phil.*, 462, 'Menbung River, Sarawak.'  
1919 *Hylopetes harrisoni caroli* Gyllenhalpe, *Kungl. Sv. Vet. Acad.*, 60, 6: 29. Northeast  
Indonesian Borneo.  
Range: Borneo.

***Hylopetes spadiceus (?) amoenus* (Miller)**

1906 *Scluropterus amoenus* Miller, *Proc. U.S. Nat. Mus.*, 31: 264. Kundur Island, Riau Archi-  
pelago.  
Range: Kundur Island, Riau Archipelago.

***Hylopetes spadiceus belone* (Thomas)**

1908 *Scluropterus (Hylopetes) belone* Thomas, *Ann. Mag. nat. Hist.*, 2: 305. Terutau Island.  
Range: Terutau Island, Straits of Malacca.

***Hylopetes spadiceus sipora* Chasen**

1940 *Hylopetes sapitta sipora* Chasen, *Bull. Raffles Mus.*, 15: 117. Sipora Island, Mentawi  
Islands, west Sumatra.  
Range: Sipora Island, Mentawi Islands, west Sumatra.

***Hylopetes lepidus lepidus* (Horsfield)**

1822 *Pteromys lepidus* Horsfield, *Zool. Res. in Java*, 5. Java.  
Range: Java.

***Hylopetes lepidus aurantiacus* (Wagner)**

1841 *Pteromys aurantiacus* Wagner, *Arch. f. Naturg.*, 7: 135. Banka Island.  
Range: Banka Island.

***Hylopetes lepidus platyurus* (Jentink)**

1890 *Scluropterus platyurus* Jentink, *Notes Leyden Mus.*, 12: 145, pl. 7, figs. 7, 8. Deli, north-  
east Sumatra.  
Range: Sumatra and Malay States.

***Hylopetes thomasi* (Hose)**

1900 *Petaurus thomasi* Hose, *Ann. Mag. Nat. Hist.*, 7: 24. Silat River, Sarawak.  
Range: Borneo.

***Hylopetes spadicens belone* (Thomas)**

Pulau Terutau, off west coast Peninsular Siam: ♂ ♂ 55.2433-2434. ♀ 55.2435  
Telok Wau.

***Ratufa bicolor***

In Java, *Ratufa bicolor* has been divided (Dammerman (1931), Chasen (1940), Sody (1949)) into two races: a dark typical race with the hairs of the head and nape warm seal brown, slightly tipped with light brown on the nape, from western Java, and a lighter coloured form, *R. b. albiceps*, from eastern Java, with the hairs of the back of the head and the nape tipped with white. Dammerman also divides these races on tail characters: the tail of the eastern form is darker than that of the form from west Java and while in both the hairs of the tail have large yellow distal ends, these are less extensive in the eastern race. Study of a series now in the British Museum (Natural History), assembled from localities throughout Java, suggests that in fact the species is distributed along a cline in that island in which certain characteristic phases of coloration occur in suitable climatic conditions (c.f. Ingoldby (1927) on *Heliosciurus*).

**Ratufa bicolor bicolor** (Sparrman)

West Java: ♂ 54.81 Oedjoengteboe, 1,000 ft. ♂ 54.78, ♀ 54.79, 54.80 (skin only) Wynkoops Bay, 100 ft.

These specimens typify the dark extreme of the cline. The hairs of the back are black based and in the lumbar region, along the flanks and on the shoulders are profusely tipped with silver. The head and nape are seal brown. A faint trace of reddening occurs along the centre of the back and on the top and back of the head. The chest and the inner sides of the forelegs are clear orange buff, as are the tips of the black based hairs of the tail. The hairs of the throat and belly are blackish brown, tipped with buff. The base of the tail and the feet are black, the cheeks and underside of the head a very pale yellow.

**Ratufa bicolor albiceps** (Desmarest)

1817 *Sciurus albiceps* Desmarest, *Nouv. Dict. Hist. Nat.* ed. 2, 10: 105. East Java.

1913 *Ratufa bicolor baliensis* Thomas, *Ann. Mag. nat. Hist.* 11: 506. Tjetockambawang, Bali.

East Java; ♂ 54.85 Tamansari, 1,400 ft. ♂ 54.82-83, ♀ 54.84 Sodong Jerok, Idjen Massif, near Banjoewangie, 3,900 ft.

In this, the lightest phase of the cline, the dorsal hairs are chestnut red at the base and are tipped with sayal brown. Black has almost entirely disappeared, except on the feet and thighs, and the greater part of the orange colour of the chest, forelegs and especially the tail in *R. b. bicolor* in *albiceps* has been replaced by buff or yellow. These specimens have the white tipped head and nape hairs typical of *albiceps*. The tail in *albiceps* is much darker than that of *bicolor*, the hairs at their bases being chestnut brown or cinnamon brown while the yellow or straw coloured tipping is confined to the terminal quarter of the hairs. Western specimens have the hairs of the tail black at the base and tipped for half their length with orange or orange buff. As suggested by Robinson and Kloss (1918a) there is no justification for the retention of *baliensis* Thomas. It represents the eastern end point of the cline and does not differ materially from *albiceps*, specimens of which were not available to Thomas at the time of his description.

**Ratufa bicolor bicolor × albiceps**

West Java: ♂ 54.87-88, ♀ 54.90, 54.92 Tjibodas, Mount Gedeh, 5,000 ft. ♀ 54.89 Tjibodas, 4,500 ft. ♀ 54.91 Tjibodas, 3,000 ft.

Middle Java: ♀ 54.86 Karangbolang.

This would seem to be the best method of designating the numerous intermediates that exist between the phases described above as *R. b. bicolor* and *R. b. albiceps*. A series from Pangandaran, south Java, is browner and is less intensely black than are specimens from Wynkoops Bay. The silver or white dorsal speckling is less profuse and does not extend beyond the flanks. Ventrally, these specimens are paler and the clear bright orange buff of the forelegs, sides of chest and tail of the Wynkoops material is replaced by a more yellow colour. In a series from Kalipoetjang, north-east of Pangandaran, the dorsal underfur is blackish brown, almost chestnut. Ventrally, these are similar to specimens from Pangandaran. Specimens from Tjibodas retain the bright orange tints on the inside of the forelegs; in other respects, 54.87-88 are similar to material from Sodong Jerok, while 54.89-91 resemble the Pangandaran series. Another, 54.92, is profusely tipped with silver on the lower back like those from Wynkoops Bay. A specimen from Tasikmalaga, Preanger, is dorsally a dark rich brown and the hairs at the back of the head are profusely tipped with yellowish white, while a specimen from

Karangbolang is exactly like *albiceps* dorsally but ventrally resembles western specimens and has the orange yellowish tail, with little black or brown colour, typical of *R. b. bicolor*. Among the intermediate material, the tail generally resembles that of western specimens: the length of the yellow portion of each hair, however, is reduced in some specimens.

*Ratufa bicolor major* Miller (Proc. Biol. Soc. Wash. 1911, 24: 28) was applied to a specimen from Tjibodas. Miller stated "similar to *Ratufa bicolor bicolor* of the lowlands of eastern Java but larger". The name probably refers to an intermediate since as shown by the material available, specimens from Tjibodas not infrequently resemble *albiceps* although their tails remain predominantly yellowish. Chasen (1940) synonymised *major* with *R. b. bicolor*. There is little difference in size between specimens from east and west Java: in the series examined the nasals of eastern specimens average a little wider than those of western material. Eight skulls of *albiceps* give for the width of the combined nasals 7.1–10.0 (8.8) while twenty four skulls of *bicolor* (including specimens classed as intermediates) give for the same measurement 5.9–8.1 (6.9).

Dorsal patches of bleached fur are present in many specimens. In examples from west and central Java these are cinnamon or sayal brown while specimens from further east have these patches a clear straw colour.

#### Variation in colour of *Ratufa bicolor* in Java

While the evidence provided by this series is not entirely conclusive, the series suggests that a cline in colour exhibited by *Ratufa bicolor* in Java is in accordance with Gloger's rule, i.e. black eumelanin deposited in conditions of high humidity and high temperature tends to be replaced by yellow or reddish brown phaeomelanin in conditions of comparative aridity and high temperature. A comparison of the colour distribution of *R. bicolor* in Java with the distribution of rainfall over that island illustrates this point: the intensely dark form is found to be confined to the wet, fairly densely forested south-western part of the island with average annual rainfall of 120–200 inches. The lighter coloured, typically *albiceps* phase is confined to the comparatively arid, less forested part of the island where the annual rainfall averages less than 80 inches and the intermediate forms to the areas where rainfall averages 80–120 inches annually. In this connection it is interesting to note that the pocket of drier country to the north of the western mountain range, i.e. Batavia-Cheribon extending inland to the mountains and including Tjibodas also produces intermediates. This area falls within the 80–120 inches of annual rainfall distribution. Altitude apparently has little effect on colour except where it modifies local climate. In texture of pelage, western specimens have slightly softer and denser fur than those from eastern localities.

#### *Ratufa bicolor peninsulae* (Miller)

Peninsular Siam: ♀ 55.1667 Khao Nong, Bandon, 1,200–1,500 ft. ♂ 55.1668 Krong Mun, Trang. ♂ 55.1669, ♀ 55.1670 Chong, Trang.

Junk Sceylon, off west coast Peninsular Siam: ♂ ♂ 55.1671–1673, ♀ ♀ 55.1674–1675 Klong Tun Sai, Tongka.

Pulau Lontar, off west coast Peninsular Siam: ♂ ♂ 55.1687–1689 Pasir Raja.

Pulau Panjang, off west coast Peninsular Siam: ♂ 55.1690, ♀ 55.1691 Telok Poh. Perlis: ♂ 55.1677 Pelerit.

Perak: 55.1676 Temengoh. ♀ 55.1683 Tanjong Kupong, Bagan Datoh. ♂ 55.1686 Parit.

Pahang: ♂ ♂ 55.1680–1681 Benom foothills. ♀ 55.1684 Kuala Tahan.

Selangor: ♀ 55.1678 Menang Gasing, Ulu Langat. ♂ 55.1679 Batu,

Malacca: ♀ 55.1685 Nyallas.

Negri Sembilan: ♀ 55.1682 Gunong Tampin, 1,000–2,700 ft.

This race ranges through the Malay Peninsula nearly as far north as the Isthmus of Kra, and although very similar in colour to *phaeopepla* is generally blacker on the upper-parts. Externally, it is somewhat smaller than *phaeopepla* and the skull averages shorter than in this race. A series from localities from most parts of its range measures: head and body 310–383 (340) (thirty specimens), tail 395–540 (435) (twenty-nine specimens) and condylobasal length 62.1–67.0 (64.6) (twenty-five specimens). Specimens from Pasir Raja, Pulau Lontar and Pulau Panjang are a little more orange on the under-parts than those from the mainland. Specimens from these islands, however, do not have the bullae reduced as in *melanopepla* from Pulau Telibon. Measurements of the length of the inflated portion of the bulla in ten specimens from Junk Seylon, Pulau Lontar and Pulau Panjang: 14.4–15.3 (14.8); in ten specimens of *peninsulae* from the mainland immediately adjacent 14.6–15.2 (14.8) and in four specimens of *melanopepla* 13.4–13.9 (13.7). Specimens from localities north of Trang have the brown element in the dorsal pelage present but are less brownish above than *phaeopepla* from localities yet farther north.

#### **Ratufa bicolor phaeopepla Miller**

Peninsular Siam: ♀ 55.1658 Tang Prau, Tahuatang, ♀ ♀ 55.1659–1661 Hat Sanuk, near Koh Lak, Raiburi. ♂ ♂ 55.1662–1663 Renong River, ♀ 55.1665 Tap-li (= Klong Wan), Pakchan, ♀ 55.1666 Tasan, Chumpawn, 220 ft.

Tenasserim: ♀ 55.1664 Victoria Point.

Dorsally, these specimens are blackish brown or chestnut brown and not black as is *peninsulae* and they average slightly larger than that race. Measurements of specimens from Peninsular Siam, Tenasserim and west Siam: head and body 334–405 (371) (twenty-one specimens), tail 419–505 (468) (twenty-one specimens) and condylobasal length 63.8–73.4 (67.6) (nineteen specimens).

#### **Ratufa bicolor melanopepla Miller**

Pulau Telibon, off west coast Peninsular Siam: ♂ ♂ 55.1692–1693, ♀ 55.1694.

#### **Ratufa bicolor fretensis Thomas and Wroughton**

Pulau Langkawi, off Perlis: ♂ ♂ 55.1697–1698, Buraw, ♂ 55.1695, ♀ 55.1696.

Pulau Terutau, off west coast Peninsular Siam: ♂ ♂ 55.1699–1701, ♀ 55.1702 Telok Watu.

#### **Ratufa bicolor penangensis Robinson and Kloss**

Penang Island: ♂ ♂ 55.1705–1706, ♀ ♀ 55.1707, 55.1708 (skin only) Telok Bahang.

Four of the original series.

#### **Ratufa bicolor dicolorata Robinson and Kloss**

Koh Samui, off Bandon, Peninsular Siam: ♂ 55.1709, ♀ ♀ 55.1710–1713.

Koh Penan, off Bandon, Peninsular Siam: ♀ 55.1714.

These specimens form part of the original series.

#### **Ratufa bicolor tiomanensis Miller**

Pulau Tioman, Pahang Archipelago: ♂ 55.1703, ♀ 55.1704 Juara Bay.

**Ratufa bicolor condorensis** Kloss

Pulau Condore, off Cochin China: ♂ 55.1715–1717.

The type specimen, originally in the collection of C. B. Kloss, is neither in Singapore nor London and is not listed by Poole and Schantz (1942) from the collection of the United States National Museum, which contains other type specimens of Sciuridae from the Kloss collection.

**Ratufa affinis aureiventer** (Geoffroy)

Negri Sembilan: ♂ 55.1719 Gunong Tampin.

Malacca: ♂ 55.1718 Nyalas.

Pahang: ♂ 55.1720 Trang.

These specimens are clearly referable to *aureiventer*. The feet of 55.1719 are washed with brown only on the digits and are otherwise the same colour as the limbs as in *johorensis*, from which this race may be distinguished by its ochraceous underparts, slightly darker back and brownish feet.

**Ratufa affinis interposita** Kloss

Selangor: ♀ 55.1727 Ginting Bidai, 2,300 ft., ♀ 55.1728 Bukit Cheraka, Jeram.

Pahang: ♂ 55.1721, ♀ 55.1722–1723 Kuala Tahan, ♀ 55.1724–1725 Kuala Teku, Tahan River, Pahang, 500 ft. ♂ 55.1726 Wray's Camp, Gunong Tahan, 3,000 ft.

This race is distinguished from *aureiventer* by its orange underparts and darker feet. Specimens from Ginting Bidai and Bukit Cheraka have the underparts orange as in *interposita* but the feet are lighter and resemble those of *aureiventer*.

**Ratufa affinis frontalis** Kloss

Dindings: ♂ 55.1731 Tanjung Hantu.

Perak: ♀ 55.1732 Bukit Gantang. ♂ 55.1729, ♀ 55.1730 Pondok Tanjong.

55.1732 (F.M.S. 562/11) has been labelled 'Type' by Kloss, who, however, took as his type F.M.S. 1034/11, now B.M. 47.1477. These specimens agree well with the type, and all have a greyish white frontal band behind the black brown muzzle. This race is easily distinguished from *interposita* by its much darker tail, blackish brown feet and darker back. The hairs of the back are markedly annulate while the thighs are brighter and more orange than those of *interposita*. The underparts are generally a little paler, and sometimes (55.1731, 34.7.18.115, Ulu Ijok, Perak) are creamy.

**Ratufa affinis klossi** subsp. nov.

*Type locality:* Lam-ra, Trang, Peninsular Siam.

*Type:* ♂ 10.10.1.36 Skin and skull in good condition. Collected 7th January, 1910 and presented by the Selangor Museum. Collector's No. 3431. F.M.S. No. 995/10.

*Other material:* ♂ ♂ 55.1733–1734, 10.10.1.37. all collected at the type locality in January–February 1910.

This race may be distinguished from *R. a. frontalis* by the absence of a grey-white frontal band and by its paler back, which resembles, but is not so pale as that of *R. a. interposita*. It may be distinguished from *R. a. pysonota* (Trang possibly north to Tenasserim (see Kloss (1916))) by its paler back and by the limbs, which are ochraceous and not ferruginous as are those of *pysonota*.

Dorsally, the type is cinnamon buff and is paler and less brown than *frontalis* or *pysonota*: there is no trace of a frontal band (although in 55.1734 this is represented by a few grey tipped hairs) while the feet are blackish brown. The thighs are ochraceous as

in *interposita* and are much paler than in *frontalis* or *pyronota*. The tail is similar to that of *frontalis*, while the underparts are slightly more orange but are not so much so as those of *pyronota*.

*Ratufa affinis klossi* is about the same size as *frontalis* and *pyronota*. Measurements of the type specimen: head and body 344, tail 410, hindfoot 75, ear 25, condylobasal length 58.1, palatal length 29.2, maxillary toothrow 12.8, zygomatic width 40.1, diastema 14.0, postorbital constriction 21.1.

The race extends southward as far as northern Perak. One example of *R. a. frontalis* from Pondok Tanjong, northwest Perak (55.1729) closely resembles it in colour but has a well marked headband. Kloss (1932) who first drew attention to a paler form in this area, records pale examples from Lam-ra, Trang and Bangnaru, Patani, south to Perak.

#### ***Ratufa affinis pyronota* Miller**

Peninsular Siam: ♂ 55.1735 Ongut, Trang.

#### ***Ratufa affinis baramensis* Bonhote**

Sarawak: ♀ 55.758-759 Bulingean. ♂ 55.755 Sungai Pelendok, Paku, Sarebas. ♀ 55.761 Paku, Sarebas. ♂ 55.753 Anyut, Paku, Sarebas. ♀ ♀ 55.756-757 Mount Dulit, Baram, 3,400 ft. 55.754 Baram (with skull in skin).

A good series from localities in northern Sarawak suggests that the amount of black on the back, used by Lyon (1911) as a diagnostic character in separating *cathurnata*, is very variable and is perhaps unreliable. One or two specimens are very black while in others the black is confined to the mid-dorsal line and to the posterior part of the back. In some the back is mainly tawny ochraceous throughout while in one or two examples the black is entirely absent. Such specimens are grizzled along the flanks with tawny ochraceous, the back being rich chestnut brown. Tails are mostly black above, but are suffused with tawny ochraceous in some specimens. The underside is cream and is stained with orange or ochraceous. The principal difference between this race and *cathurnata* of south-east Borneo lies in the thighs, which are very rufous in contrast to the paler yellow or ochraceous thighs of *cathurnata*.

#### ***Ratufa affinis cathurnata* Lyon**

Sarawak: ♂ 55.763, ♀ 55.764 Entawa, Samarahan. ♂ 55.762 Mora Barue, Samarahan. ♂ 55.760 Gunong Sidong, Samarahan, 1,200 ft.

Specimens from Entawa and Mora Barue agree well with the description by Lyon and with 10.4.5.101 from Poeroek Tjahoe, Barito River, which is also referred to this race. The black of the back is not sharply defined and the thighs are ochraceous and are the same colour as the underside of the body. The area of dorsal black is variable: 10.4.5.101 and 55.763 have more dorsal black than 55.764 and 55.762 which above are mainly chestnut colour. Specimens from Bukit Sibu, Batang Lumar and Bejalong show in some respects an approach towards *baramensis*. 5.3.1.10, 5.3.1.12 from Bukit Sibu closely resemble *cathurnata*; they have little black dorsally or in the tail and the thighs are the same colour as the underside of the body. 5.3.1.11 from the same locality, however, is darker on the back and the thighs show a considerable infusion of rufous. 92.11.28.12 from Batang Lumar has no black dorsally and is rufous on the thighs. 55.760 from Gunong Sidong closely resembles material from the Sarebas district and has very rufous thighs, while 5.3.1.13 from Bejalong, while very dark above, has ochraceous thighs approaching those of *cathurnata*.

*Callosciurus caniceps concolor* (Blyth)

Perlis: ♀ ♀ 55.1798-1799 Pelarit. ♂ 55.1803 Padang Sireh, Perlis-Singgora border.

Kedah: ♀ 55.1797 Gurun, 50 ft.

Trengganu: ♂ ♂ 55.1833, 55.1834 (skin only) Bukit Jong.

Perak: ♂ ♂ 55.1800-1801 Temengoh. ♂ 55.1802 Lenggong. ♀ ♀ 55.1804-1805 Gunong Ijau. ♀ 55.1806 Ulu Selama. ♂ 55.1807 Bukit Padang. ♂ 55.1808 Maxwell's Hill, 4,200 ft. ♀ ♀ 55.1809-1810 Maxwell's Hill, 4,000 ft.

Pahang: ♂ 55.1811 Telom, Perak-Pahang border, 3,500 ft. ♀ 55.1812 Kuala Lipis. ♀ ♀ 55.1813-1814 Punjum, Kuala Lipis. ♂ 55.1815 Kota Tongkat, Kuantan Road. ♀ 55.1816 Bentong. ♀ 55.1817 Semangko Pass, Selangor-Pahang boundary, 2,700 ft.

Selangor: ♂ ♂ 55.1818-1819 Dusun Tua. ♂ 55.1820, ♀ ♀ 55.1821-1823 Kuala Lumpur. ♀ 55.1824 Weld's Hill, Kuala Lumpur. ♂ 55.1825 Cheras, Ulu Langat. 55.1826 Menang Gasing, Ulu Langat. ♀ 55.1827 Klang Gates. ♂ 55.1828 Ginting Bidai.

Malacca: ♂ 55.1829, ♀ ♀ 55.1830-1831 Nyalas.

Johore: ♂ 55.1832 Padang Tuan Segamat.

This form occurs throughout the Malay States. Its dorsal surface is a grizzle of black, grey and buff, infused to a greater or lesser extent with rufous. The arms and thighs are grey, as is the ventral surface and there are no rufous patches on the flanks, sides of the neck or on the underside of the base of the tail, the hairs in these areas being grey based and tipped with buff. The dorsal surface of the tail for its proximal third is generally the same colour as the back but the distal portion often has the hairs heavily annulated with black (sometimes producing successive black rings along the tail) and in many specimens tipped with pale buff. The ventral surface of the tail closely resembles but is slightly paler than the upper surface. The tail has a very diffuse dark tip. There is little variation in colour over the range; a few specimens from Perlis and the extreme south of Peninsular Siam are slightly paler and less rufous dorsally than those from localities further south. The upper surface of the tail in these and other specimens from northern localities is buffy for most of its length and less rufous than in more southerly specimens. Measurements of fifty specimens: head and body 187-240 (209), tail 165-223 (191) and condylobasal length 45.5-50.9 (48.1).

*Callosciurus caniceps milleri* (Robinson and Wroughton)

Peninsular Siam: ♀ ♀ 55.1788-1790 Ban Kok Klap, Bandon. ♀ 55.1791 Ko-Khau, Trang. ♂ ♂ 55.1792-1793 Lam-ra, Trang. ♂ ♂ 55.1794-1795. ♀ 55.1796 Chong, Trang.

A series of specimens from various localities in Trang has the dorsal surface similar to that of *concolor* but entirely lacks any trace of the rufous colour characteristic of the more southerly race. The tail is buff grey dorsally throughout its length and has a distinct black tip. Its underside is generally paler than the upper surface and sometimes has a central buffy stripe. Ventrally, these specimens are grey but have varying amounts of ochraceous or rufous on the flanks, sides of the neck, the base of the tail and the inguinal region. In some specimens, however, the ochraceous or rufous colour is almost entirely obsolete. Specimens from Bandon have no ochraceous on the flanks, the base of the tail, the sides of the neck or the inguinal region but otherwise closely resemble those from Trang. Apart from greater average size, this race may be distinguished from *concolor* by

the comparative pallor of the upper surface and its greyish tail. Measurements of seventeen skins and nineteen skulls: head and body 210–240 (220), tail 182–226 (209) and condylobasal length 47.8–52.5 (49.6). *Callosciurus caniceps milleri* ranges through the Malay Peninsula from Bandon on the east coast through Trang to north of Perlis and Patani. Its area of intergradation with *concolor* is unrepresented in the British Museum (Natural History): specimens from Perlis and Patani, although paler than *concolor* from further south, are undoubtedly referable to that race. On the west coast of the Peninsula, *milleri* intergrades with *epomophorus* at about the latitude of Krabi.

***Callosciurus caniceps epomophorus* × *milleri***

Peninsular Siam: ♂ ♂ 55.1782–1783, ♀ ♀ 55.1784–1787 Nongkok, Grabi (— Krabi). ♂ ♂ 55.1776 (skin only), 55.1777–1778, 55.1779 (skin only), 55.1781A (skin only), ♀ ♀ 55.1780–1781 Khanduli.

Two distinct populations fall under this heading. Specimens from Nongkok are grey on the belly and are paler on the back than typical *epomophorus*, while the patches of colour on the flanks, underparts, the sides of the neck and the underside of the base of the tail are strongly rufous and are brighter than in that race. Dorsally, specimens from Khanduli resemble those from Nongkok, but ventrally are a somewhat paler grey with the flank, ventral, neck and tail patches paler and more ochraceous, much as in *milleri* of Trang. These specimens, however, average darker on the back than this race. Measurements of thirteen skins and nine skulls: head and body 190–225 (210), tail 205–240 (222) and condylobasal length 48.2–53.5 (51.0).

***Callosciurus caniceps epomophorus* (Bonhote)**

Junk Seylon, off coast of Peninsular Siam: ♂ ♂ 55.1756–1759 Telok Pales, Tongka. ♂ ♂ 55.1760–1762, ♀ ♀ 55.1763 (skin only), 55.1764 Klong Tun Sai, Tongka.

Pulau Sireh, off west coast Peninsular Siam: ♂ ♂ 55.1765–1769.

Pulau Lontar, off west coast Peninsular Siam: ♂ ♂ 55.1770–1773, ♀ ♀ 55.1774–1775 Pasir Raja.

Specimens from Junk Seylon are dark grey on the back and are darker above than any of the mainland forms: generally the dorsal hairs are less coarsely tipped with buff than those of the specimens recorded above as *epomophorus* × *milleri*. Above, the tail is the same colour as the back and has a sharply defined black tip. Ventrally, these specimens are grey, with dull rufous patches on the sides of the neck, the flanks, the underside of the base of the tail and the inguinal region. In a few specimens a faint ochraceous tinge spreads from the flanks across the back towards the median line. Specimens from Pulau Sireh are slightly paler above than are those from Junk Seylon and the hairs on the back are more coarsely tipped with buff. They are slightly paler grey beneath, and the rufous patches, which are more extensive than those of specimens from Junk Seylon, are brighter in colour and are similar to those of the specimens recorded here as *epomophorus* × *milleri*. Ventrally, material from Pulau Sireh closely resembles these specimens, but dorsally is considerably darker. Dorsally, specimens from Pasir Raja are paler than *epomophorus* from Junk Seylon and correspond with those from Pulau Sireh. Ventrally, however, they are dark grey with dull rufous patches and are identical with the Junk Seylon specimens. Measurements of thirty-seven skins and seventeen skulls: head and body 186–230 (215), tail 170–228 (205) (thirty-six specimens) and condylobasal length 49.1–51.8 (50.7).

***Callosciurus caniceps epomophorus* × *davisoni***

De Lisle (= Koh Pram) Island, off west coast Peninsular Siam: ♂ 55.1754, ♀ 55.1755.

Peninsular Siam: ♀ ♀ 55.1750–1753 Tang Pran, Tahuatang.

This material is intermediate between *epomophorus* and the more northerly *davisoni*. The flanks, shoulder patches and the underside of the base of the tail in *davisoni* are ochraceous or buffy; in these specimens these areas are rufous but are less bright than in *epomophorus*. Those from De Lisle Island are dark grey above and below with dull rufous patches and resemble *epomophorus* more closely than do those from Tang Pran which are paler above and are lighter grey with paler ventral patches. Measurements: head and body 214–241 (229) (thirteen skins), tail 185–223 (211) (twelve skins) and condylobasal length 49.8–52.0 (51.2) (five skulls).

***Callosciurus caniceps davisoni* (Bonhote)**

Peninsular Siam: ♂ ♂ 55.1742–1743, ♀ ♀ 55.1744–1745 Renong River. ♂ 55.1746 Nam Chuk, Pakchan. ♀ ♀ 55.1747–1749 Marmok, Pakchan.

*Callosciurus caniceps davisoni* is paler on the back than *epomophorus* and has the flank, neck and ventral patches ochraceous or buffy. It is considerably darker above than *inexpectatus* and north of the latitude of Koh Luk is confined to the west coast of the Peninsula, extending into Tenasserim. From the Isthmus of Kra, south of Koh Luk, we have specimens from Marmok and Nam Chuk, Pakchan; Tasan, Chumpawn; and the Renong River. These in some cases have the flank, ventral and especially the neck patches rufous and approach the brighter phase *epomophorus* × *davisoni*. Measurements of thirty-four skins and twenty-four skulls; head and body 212–249 (228), tail 180–235 (220) and condylobasal length 48.9–52.9 (51.0).

Numerous races of *Callosciurus caniceps* occur on the adjacent islands of the Mergui Archipelago. Of these, *tabaudius* Thomas (Tavoy Island), *hastilis* Thomas (Hastings Island), *sullivanus* Miller (Sullivan Island) and *domelicus* Miller (Domel Island) are represented in London. The two former races were synonymised with *davisoni* by Ellerman and Morrison-Scott (1951), but *hastilis* may be distinguished from *davisoni* by its much greyer back and underparts, while *tabaudius*, when compared with *davisoni*, is darker above and below and is grey only on the forearms. It differs completely from *hastilis* in its dark, olivaceous back, which has a rufous tinge, and in its very dark tail, which is the same colour as the back, and not grey as in *hastilis*. *Callosciurus caniceps sullivanus* is closely similar to *davisoni* but is slightly darker. Specimens from Kisserring Island and Sir John Malcolm Island are dark grey above and below and lack grey on the underparts as does *tabaudius* but lack, however, the rufous tinge found on the back in this race. This material seems referable to *domelicus* and not to *davisoni* as thought by Ellerman and Morrison-Scott (1951) from which it differs in its much darker back and underparts and in the absence of grey from the belly. Specimens from King Island are near to *davisoni* and are much paler above and below than the other Mergui races represented in London.

***Callosciurus caniceps inexpectatus* (Kloss)**

Peninsular Siam: ♂ ♂ 55.1736–1737, ♀ 55.1738 Koh Luk, Raiburi. ♂ 55.1739, ♀ ♀ 55.1740–1741 Hat Sanuk, near Koh Luk.

*Callosciurus caniceps inexpectatus* is confined to the east coast of the Malay Peninsula from about the latitude of Koh Luk north to Bhejburi (specimens in British Museum (Natural History)). Dorsally, it is much paler than *davisoni* and although it is similar

in colour ventrally the patches are pale ochraceous and in some specimens are absent altogether. Measurements of fifteen skins and five skulls: head and body 212–230 (225), tail 214–243 (229) and condylobasal length 49.2–51.0 (49.6).

**Callosciurus caniceps lancavensis (Miller)**

Pulau Langkawi, off Perlis: ♂ 55.1885, ♀ 55.1886–1887 Kuala Kubong Badak  
Pulau Dayang Bunting, near Pulau Langkawi: ♂ ♂ 55.1888–1889, ♀ 55.1890.

A series of seventeen skins shows that dorsally and in tail colour *C. c. lancavensis* exactly resembles *milleri* of Trang. There is little variation in the dorsal colour except that in a few specimens a faint tinge of ochraceous appears on the back. Ventrally, however, *lancavensis* differs from *milleri* in the almost complete absence of ochraceous patches on the sides of the neck, the flanks and the groin. Post-auricular and flank patches are absent or at most are represented by a few buff tipped hairs, while groin patches are generally absent but in a few specimens are represented by a small area of rufous or ochraceous hairs and in one specimen, 9.11.1.53, by an extensive patch of ochraceous in the inguinal region and over the base of the tail. Ventrally, *lancavensis* represents a condition midway between *milleri* and *concolor*. Measurements: head and body 210–230 (220) (sixteen skins), tail 164–215 (200) (fifteen skins), condylobasal length 46.4–50.5 (48.9) and zygomatic width 29.1–31.5 (29.7) (sixteen skulls in both instances).

**Callosciurus caniceps terutavensis (Thomas and Wroughton)**

Pulau Terutau, off west coast Peninsular Siam: ♂ ♂ 55.1907–1910 Telok Wau. ♂ 55.1911, ♀ ♀ 55.1912–1914.

This race is only barely separable from *lancavensis* from the adjacent island of Langkawi. Dorsally, skins from Terutau exactly resemble a series from Langkawi and also *milleri* from Trang. Ventrally, however, those from Terutau are very slightly darker than *lancavensis*, and most examples entirely lack any trace of ochraceous patches. In a minority of specimens these are represented by a few buffy hairs in the groin. The ventral surface of the tail in the majority of specimens from Terutau has a median stripe of ochraceous or buffy: this, however, is present in a more diffuse form in a few of the Langkawi specimens, which otherwise have the ventral surface of the tail paler than, though the same colour as its upper surface. Measurements of eighteen skins and seventeen skulls from Pulau Terutau: head and body 190–235 (218), tail 190–220 (207), condylobasal length 46.6–50.3 (48.5) and zygomatic width 28.4–31.5 (30.2).

**Callosciurus caniceps adangensis (Miller)**

Pulau Adang, Butang Islands: ♂ ♂ 55.1835–1836.

Pulau Rawi, Butang Islands: ♂ ♂ 55.1837–1838.

These specimens are very similar in colour above and below to *terutavensis* and *lancavensis*: there are no ochraceous post-auricular or flank patches and a few ochraceous hairs in the groin represent the inguinal patch. There is a central stripe of ochraceous or buffy on the ventral surface of the tail similar to that found in *terutavensis*. *Callosciurus caniceps adangensis* is distinguished from *terutavensis* and *lancavensis* by its shorter skull. Measurements of four specimens: head and body 196–209 (204), tail 149–216 (182) and condylobasal length 46.8–47.8 (47.3). Specimens from Pulau Rawi have the feet slightly darker and less speckled with grey than those from Pulau Adang.

***Callosciurus caniceps telibius* Thomas and Robinson**

Pulau Telibon, off west coast Peninsular Siam: ♂ 55.1870, ♀ 55.1871–1873.

These specimens agree closely with the type and in colour are very similar to *concolor* from Kedah, Perlis and the extreme south of Peninsular Siam. There is, however, a distinct black tail tip in *telibius* as in *milleri*, *lancavensis* and *terutavensis* and the majority of specimens of *telibius* have the ventral surface of the tail with an ochraceous median stripe, which in some cases extends the full length of the tail and which in other examples is confined to the distal half. The skull is shorter than that of *milleri*, *concolor*, *lancavensis* or *terutavensis* and resembles that of *adangensis*. There are no ochraceous post-audicular or ventral patches. Measurements of eight skins and five skulls: head and body 194–209 (203), tail 184–206 (194), condylobasal length 46.2–47.3 (46.7).

***Callosciurus caniceps panjus* Thomas and Robinson**

Pulau Panjang, off west coast Peninsular Siam: ♂ 55.1874, ♀ 55.1875–1883, 55.1884 (skin only) Telok Poh.

Distinguished from *epomophorus* by its whitish ears, wrists and inguinal region but otherwise in colour exactly like specimens from Junk Seylon. ♀ 55.1883 has the red on neck, flanks and the base of the tail considerably increased; that on the neck and flanks extends over the shoulders and in this respect this specimen resembles *panjoli*. Measurements of fourteen skins and eleven skulls: head and body 210–230 (222), tail 170–240 (213) and condylobasal length 49.5–53.0 (51.6). This race averages very slightly larger than *epomophorus*.

***Callosciurus caniceps panjoli* Thomas and Robinson**

Pulau Panjang Anak, near Junk Seylon, off west coast Peninsular Siam ♀ 55.1866–1869, ♂ 55.1865.

Like *panjus*, but with ears pale grey and with hind feet averaging darker. Neck and flanks patches extending along sides and forming a dull red suffusion over the shoulders; otherwise exactly like *epomophorus* or *panjus*, but tail greyer above and below, lacking the ochraceous or buff suffusion along the ventral midrib found in these races. Ventral patches as in *epomophorus*. Measurements of nine skins and six skulls: head and body 215–230 (222), tail 210–241 (225) and condylobasal length 50.9–54.2 (52.3).

***Callosciurus caniceps nakanus* Thomas and Robinson**

Koh Naka, near Junk Seylon, off west coast Peninsular Siam: ♂ 55.1851–1854, ♀ 55.1855.

A further development of the trend of colour exhibited by *panjus* and *panjoli* in which the rufous of the neck and flanks has spread over the entire nape, towards the mid-line of the back and on to the inner surface of the thighs. Centre of back a grizzle of buff, grey and black. Tail buffy above, below rufous at the base with a strong buff or ochraceous suffusion, particularly on the midrib, over the remainder. Measurements of nine skins and six skulls: head and body 200–220 (216), tail 200–232 (209) and condylobasal length 49.1–51.2 (50.1).

***Callosciurus caniceps mapravis* Thomas and Robinson**

Koh Mapraw, near Junk Seylon, off west coast Peninsular Siam: ♂ 55.1856, ♀ 55.1857–1861.

Dorsally like *panjus* and with whitish ears, wrists and forefoot. Hindfoot pale grey. Ventrally, much paler, particularly on chin and throat, which are whitish. Belly in some

specimens whitish, but in most a dirty, pale grey, stained with ochraceous or buff. Neck, flank and groin patches as in *panjus*. Tail more bushy below than in this race. Measurements of eleven skins and six skulls: head and body 200–220 (216), tail 190–215 (206) and condylobasal length 49.8–51.5 (50.7).

***Callosciurus caniceps tacopius* Thomas and Robinson**

Koh Rah, Takopah, off west coast Peninsular Siam: ♂ ♂ 55.1862–1863, ♀ 55.1864.

This race is much more ochraceous on the back than *epomophorus* and the hairs of the back and tail are profusely tipped with ochraceous. The ventral surface is heavily ochraceous or rufous. Tail as in *mapravix*. Measurements of six skins and four skulls: head and body 205–226 (215), tail 186–225 (209) and condylobasal length 49.8–51.8 (50.4). *Callosciurus caniceps pipidoni* Thomas and Robinson (which is unrepresented in the Robinson collection but of which there are specimens in the British Museum (Natural History)) dorsally is inseparable on colour from specimens from Khanduli and Nongkok on the adjacent mainland described above as *C. c. epomophorus* × *milleri*. Ventrally, they show no differences in colour from those from Nongkok and are about the same size. Measurements of four skins and one skull: head and body 210–225 (218), tail 197–220 (205) and condylobasal length 49.7.

***Callosciurus caniceps moheius* Thomas and Robinson**

Pulau Mohea (North), off west coast Peninsular Siam: ♂ ♂ 55.1915–1916, ♀ 55.1917.

*Callosciurus caniceps moheius* represents a further step in the trend shown by *milleri*, *lancavensis*, *terutavensis* and *adangensis* in which buff has for the most part replaced the grey of the back. As in these races, there are no flank patches while post auricular and groin patches are represented by a few deep buff or ochraceous hairs. The ventral midrib of the black tipped tail is bright ochraceous. Measurements: head and body 173–202 (191) (six skins), tail 171–198 (182) (five skins) and condylobasal length 40.8–44.6 (42.6) (four skins).

***Callosciurus caniceps mohillius* Thomas and Robinson**

Pulau Mohea (South), off coast of Peninsular Siam: ♂ 55.1918, ♀ ♀ 55.1919–1920.

This race seems only barely separable from *C. c. moheius* and in all major characters is identical with it. Small series of the two races can be separated only by the slightly darker colour above and below of *mohillius*, which has greyer underparts and greyish, not whitish thighs. The ochraceous groin patches are more prominent in *mohillius*. Additional specimens to those examined at the British Museum (Natural History) by Thomas and Robinson show that the ochraceous or buff ventral midrib of the tail is quite as prominent in some specimens at least of this race as in *moheius*. Measurements of seven skins and four skulls: head and body 175–193 (186), tail 162–182 (172) and condylobasal length 40.7–43.2 (42.1).

***Callosciurus caniceps fallax* (Robinson and Kloss)**

Koh Pennan; off Bandon, Peninsular Siam: ♂ ♂ 55.1891–1898, ♀ ♀ 55.1899–1906.

This race is very close to *milleri* from the adjacent mainland: it averages slightly darker on the underparts and the belly and chest are clear grey and are rarely suffused with ochraceous. Post-auricular and flank patches are pale ochraceous and not well

defined. *Callosciurus caniceps fallax* averages larger than *milleri*. Measurements of sixteen skins and fifteen skulls: head and body 217–245 (230), tail 216–239 (228) and condylobasal length 49.9–53.4 (51.8). The skin of the type specimen (F.M.S. 134/13) is 21.11.8.9 in the collection of the British Museum (Natural History); the skull, however, cannot be found in this collection and apparently is missing.

***Callosciurus caniceps samoensis* (Robinson and Kloss)**

Koh Samui, off Bandon, Peninsular Siam: ♂ ♂ 55.1839–1844, ♀ ♀ 55.1845–1850.

Dorsally, more buff and less grey than *epomophorus*, approaching *tacophilus*. Ventrally, clear grey, sometimes suffused with whitish, as in *mapravix*. Post-auricular, flank and groin patches, and the base of the tail ventrally strongly rufous as in *epomophorus*. Measurements of twelve skins and eleven skulls: head and body 208–242 (227), tail 216–244 (228) and condylobasal length 49.6–53.1 (51.6). This race is unlike any east coast specimens in the British Museum (Natural History) (those we have are from Bandon and are referred to *milleri*) and resembles more closely the west coastal island forms *epomophorus*, *panjicus*, *panjolii* and *tacophilus* in the more vigorous development of ochraceous and rufous tints.

***Callosciurus erythraeus youngi* (Robinson and Kloss)**

Pahang: ♂ 55.1948, ♀ 55.1949 Teku Plateau, Gunong Tahan, 5,000–6,000 ft. ♀ ♀ 55.1950–1951 Wray's Camp, Gunong Tahan, 3,000 ft.

Selangor: ♂ ♂ 55.1942–1943, ♀ ♀ 55.1944–1945 Gunong Mengkuang, Lebar, 4,800 ft. ♂ 55.1946, ♀ 55.1947 Bukit Fraser, above Semangko Pass, Selangor-Pahang boundary, 4,000 ft. ♀ 55.1952 Menang Gasing, Ulu Langat, 3,000–4,000 ft.

Closely similar in colour to, but differing from *rufeculus* by its slightly darker back and tail, the hairs of which (in this small series) have less coarse subterminal annulations which in these specimens are rufous orange. Measurements of twelve skins and eleven skulls: head and body 175–208 (197), tail 170–195 (185) and condylobasal length 45.2–49.0 (47.1).

***Callosciurus erythraeus rubeculus* (Miller)**

Peninsular Siam: ♂ ♂ 55.1936–1938 Kao Nong, Bandon, 3,500 ft. ♀ 55.1939 Kao Tung Sawng, Bandon, 2,500 ft. ♂ 55.1940 Khao Luang, Nakon Sri Tamarat, 3,000 ft.

Perak: ♂ 55.1941 Gunong Kerbau, 5,000 ft.

These specimens agree closely with the description by Miller. The subterminal annulations of the hairs of the tail in specimens from Bandon are ochraceous while those specimens from the southern part of Peninsular Siam and Upper Perak have these annulations rufous orange, as had the type from Trang. The rufous stripes on the underparts in 55.1936 and 55.1938 are much reduced. The series averages larger than that listed above as *C. e. youngi*. Measurements: head and body 202–240 (213) (six skins), tail 193–214 (207) (five skins) and condylobasal length 47.8–50.6 (49.1) (six skulls).

***Callosciurus erythraeus pranis* (Kloss)**

Peninsular Siam: ♂ ♂ 55.1927–1929, ♀ ♀ 55.1930–1931 Koh Lak, Raiburi. ♂ 55.1932, ♀ ♀ 55.1933–1935 Hat Sanuk, near Koh Lak.

The same range of colour variation as that described by Kloss in the original series is exhibited by this small series of specimens: these were collected in April and the

original series in November. Measurements of eight skins and seven skulls: head and body 192–207 (201), tail 180–222 (203) and condylobasal length 44.1–47.1 (45.5).

**Callosciurus erythraeus tachin (Kloss)**

Central Siam: ♂ ♂ 55.1921–1924, ♀ ♀ 55.1925–1926 Bangkok.

These specimens are referred to *C. e. tachin* (which has not been available for direct comparison) on account of their smaller size. In colour they differ in some respects from the description by Kloss and from each other. Dorsally, the grey based hairs are tipped with buff or in some specimens with ochraceous and in one, 55.1926, with rufous. The muzzle and top of the head is rufous. Four specimens have an indistinct black patch on the rump. Tail usually black and buff; in 55.1924 and 55.1925 rufous for its distal half and in 55.1926 rufous tipped. In 55.1923 tail tipped with black hairs, annulated with buff. Underparts having little or no trace of a grizzle of buff and grey on the chin, chest and throat, this condition distinct only in 55.1922, the underside varying from yellowish to deep rufous. These specimens were collected in February. Measurements of six skins: head and body 170–180 (177), tail 125–185 (159). Of five skulls (except where stated): greatest length 44.6–47.2 (45.4), condylobasal length 41.9–43.5 (42.5), condylobasilar length 38.7–40.1 (39.4), palatal length 21.7–22.8 (22.4), palatilar length 18.6–19.6 (19.1), maxillary toothrow 8.8–9.6 (9.3) (four specimens), interorbital width 15.1–17.3 (16.0), zygomatic width 26.5–28.2 (27.3), diastema 10.1–10.4 (10.2) (four specimens).

**Callosciurus finlaysoni germaini (Milne Edwards)**

Pulau Condore, off Cochin China: ♂ ♂ 55.1953–1955, ♀ ♀ 55.1956–1959.

This race is jet black like *C. f. nox* but, compared with this form, is considerably reduced in size. Measurements of seven skins: head and body 175–193 (179), tail 150–178 (167), hindfoot 37–41 (39), ear 18–21 (19). Of six skulls (except where stated): greatest length 47.2–48.4 (47.3), condylobasal length 42.9–44.7 (43.7), palatal length 22.9–23.8 (23.6), maxillary toothrow 9.2–9.7 (9.5), zygomatic width 27.4–28.5 (27.9) (four specimens), interorbital width 16.1–17.5 (16.9). Of eight skins of *C. f. nox*: head and body 195–235 (217), tail 158–231 (204), hindfoot 46–51 (48), ear 19–23 (21) (six specimens). Of six skulls (except where stated) of the latter form: greatest length 52.4–54.7 (53.6) (four specimens), condylobasal length 48.8–50.6 (49.9) (four specimens), palatal length 26.2–27.6 (26.8), maxillary toothrow 9.8–10.9 (10.3), zygomatic width 31.3–32.5 (31.7) (five specimens), interorbital width 18.4–20.7 (19.5).

**Callosciurus prevosti prevosti (Desmarest)**

Pahang: ♀ 55.1962 Triang, ♀ 55.1964 Laban Chinlong, Rompin.

Malacca: ♀ 55.1963 Nyalas.

Negri Sembilan: ♀ ♀ 55.1960–1961 Ayer Kring.

♀ 55.1962 (F.M.S. 481/12) is one of those mentioned by Robinson (1916) in the description of *Sciurus prevosti* ab. *meticulosus*, a name omitted by Chasen (1940) but treated by Ellerman (1940) as a synonym of *Callosciurus prevosti*.

**Callosciurus prevosti wrayi (Kloss)**

Peninsular Siam: ♂ 55.1966 Chong, Trang.

Perak: ♂ 55.1965 Temengoh, ♀ 55.1968 Ulu Selama.

Dindings: ♂ 55.1970, ♀ ♀ 55.1971–1974 Tanjung Hantu.

Pahang: ♀ 55.1967 Benom foothills, ♂ 55.1969 Kuala Teku.

***Callosciurus prevosti humei* Bonhote**

Perak: ♀ 55.1975 Parit, ♂ 55.1976 Sungkai, ♂ ♂ 55.1980–1981, ♀ ♀ 55.1982–1983 Changkat Mentri. ♀ 55.1979 Tanjong Malim, Perak–Selangor boundary. Selangor: ♂ 55.1977 Bukit Cheraka, ♂ 55.1978 Cheras, 9th mile Kuala Lumpur Rd, ♂ 55.1984 Rantau Panjang, Rawang, ♂ 55.1985, ♀ ♀ 55.1986–1987 Rawang.

***Callosciurus prevosti atricapillus* (Schlegel)**

Sarawak: ♂ ♂ 55.768–770, ♀ ♀ 55.771–773 Anyut, Paku, Sarebas, ♂ 55.774, ♀ ♀ 55.775–779 Paku, Sarebas, ♀ 55.780 Udan, Paku, Sarebas.

This race, and the three following, are fully described (using in part the specimens listed here) by Banks (1931).

***Callosciurus prevosti sarawakensis* (Gray)**

Sarawak: ♂ ♂ 55.781–782 Gunong Sidong, Samarahan, ♂ 55.783 Bukar, Samarahan, ♂ 55.784 Mora Barue, Samarahan.

Banks (1931) synonymises this race with *borneoensis* Müller and Schlegel from Pontianak. This latter race is unrepresented in the British Museum (Natural History) and, following Chasen (1940), the name *sarawakensis* is used for these specimens.

***Callosciurus prevosti griseicauda* (Bonhote)**

Sarawak: ♂ ♂ 55.785–790 Mount Dulit, Baram.

***Callosciurus prevosti caroli* (Bonhote)**

Sarawak: ♂ 55.791, ♀ ♀ 55.792–794 Balingean.

***Callosciurus prevosti piceus* (Peters)**

Sumatra: ♀ 55.1988 Toetoeangan, Deli, 55.1989 Tanjung Slamut, Langkat.

***Callosciurus notatus* (Boddaert)**

The variations of *Callosciurus notatus* in Java are described in considerable detail by Sody (1929), Dammerman (1931) and Sody (1933). A small series of specimens in the collection of the British Museum (Natural History) (including the types of *balstoni*, *madurensis*, *tamansari*, *andrewsi* and *stresmanni*) suggests that the extensive " lumping" whereby Dammerman (1931) and, following him, Chasen (1940) recognised two races and an intermediate form from that island is unjustified. There appear to be four well-marked races of *C. notatus* in Java:

***Callosciurus notatus notatus* (Boddaert)**

1785 *Sciurus notatus* Boddaert, Elench. Anim., 119. West Java.

1901 *Sciurus andrewsi* Bonhote, Ann. Mag. nat. Hist. 7: 456. Tjigombong, West Java.

A number of other synonyms (some of doubtful application) are listed by Chasen (1940).

West Java: ♀ ♀ 54.93–96 Wynkoops Bay, ♂ 54.97, ♀ ♀ 54.98–99 Oedjoengteboe.

A grey bellied race, sometimes with a slight suffusion of ochraceous on the underparts, particularly in the inguinal region, confined to those parts of south-west Java where the rainfall is high (i.e. greater than 120 inches per annum).

***Callosciurus notatus balstoni* (Robinson and Wroughton)**

1911 *Sciurus notatus balstoni* Robinson and Wroughton, J. Fred. Mus. Min. 4: 234. Ipias Jap, south central Java.

This race appears to be confined to the comparatively less wet zone of central and west Java where the annual rainfall approximates from 80 to 120 inches. It has the grey based hairs of the belly tipped with yellow or with orange yellow. The eye rings are broad and are yellow in colour, as distinct from those of *C. n. notatus*, in which they are narrow and buffy. Dorsally, the race differs little from *notatus*. Closely similar material can be expected from the drier 'pocket' on the north coast of Java, approximately from Batavia-Cheribon inland to the central mountain range and in fact a specimen from Batavia is indistinguishable from those from Tjilatjap. Intermediates are found along the edges of the zone: *C. n. vanheurni* Sody (Natuurk. Tijdschr. Ned.-Ind. 1928, 88: 330, Tjipunas, near Garoet, west Java) is apparently one such between *balstoni* and *notatus*.

#### *Callosciurus notatus madurae* (Thomas)

1910 *Sciurus notatus madurensis* Thomas, Ann. Mag. Nat. Hist. 5: 386, Madura Island.

East Java: ♂ ♂ 54.100–101, ♀ ♀ 54.102–103 Badjoelmati.

This race is confined to Madura island and to the comparatively arid coastal plain of north east Java. *C. n. madurae* is a pallid race with a yellowish tail, narrow orange yellow eye ring and pale yellow or ochraceous dull underparts. The dorsal surface is paler than that of *balstoni* or *tamansari*. This race, with *tamansari*, occurs in that part of Java where the annual rainfall averages less than 80 inches. *Callosciurus notatus verbeekii* Sody (Natuurk. Tijdschr. Ned.-Ind. 1928, 88: 330, Bandar, Pandangan district, Rembang, Java) refers apparently to an intermediate between this race and *balstoni*.

#### *Callosciurus notatus tamansari* (Kloss)

1921 *Sciurus notatus tamansari* Kloss, J. Fed. Mal. St. Mus. 10: 230, Idjen Massif, East Java, 1,600 ft.

East Java: ♀ 54.104 Tamansari.

One of the original series. A form in which the underparts are more richly ochraceous than in the foregoing races and which has the tail more ochraceous above and below. Dorsally, less grey than *balstoni* or *madurae* and tinged on the back with ochraceous. *Callosciurus notatus tamansari* may in fact be a synonym of *C. n. stresemanni* (Thomas) (Ann. Mag. nat. Hist. 1913, 11: 505) from Bali (Sody (1933) (1949)); the type of *stresemanni* (the only specimen available), however, can be separated from *tamansari* by its more buffy dorsal surface and by its more richly ochraceous underside, in which the orange colour extends on to the throat and the underside of the head.

While the series as a whole confirms the view of Dammerman (1931) that this species in Java forms a cline in accordance with Gloger's rule there is evidence to suggest that the cline divides into a number of fairly well defined races whose limits correspond approximately with the major rainfall divisions of the island.

#### *Callosciurus notatus miniatus* (Miller)

Peninsular Siam; ♀ ♀ 55.1990–1991 Khao Ram, Nakhon Sri Thammarat, ♀ 55.1992 Tang Pran, Tahuatung, ♂ 55.1993, ♀ 55.1994 Kao Nong, Bandon, 1,200–1,500 ft. ♂ 55.1995, ♀ ♀ 55.1996–1997 Chong, Trang, ♂ 55.1998 Gap, Patelung.

Perlis: ♀ ♀ 55.1999–2001 Pelearit.

Kedah: ♂ ♂ 55.2004–2005 Kedah Peak, 3,000 ft. ♂ 55.2006, ♀ 55.2007 Gurun, 50 ft.

Perak: ♀ 55.2002 Lenggong, ♂ 55.2003 Ulu Selama, ♀ 55.2008 Bukit Padang, ♂ 55.2009, ♀ 55.2010 Pondok Tanjong, ♂ 55.2011 Batu Tegor, near Taiping Hill, ♂ ♂ 55.2012–2013, ♀ 55.2014 Telom, Perak-Pahang boundary.

Dindings: ♂ ♂ 55.2015–2016, ♀ ♀ 55.2017–2020 Tanjong Hantu.

Pahang: ♂ 55.2021 Labau Chindong, ♀ 55.2022 Kuala Rompin, ♀ 55.2023 Gunong Sinyum, ♂ 55.2024 Bentong, ♂ 55.2025, ♀ 55.2026 Genting, Kuala Lipis, ♂ 55.2027 Wray's Camp, Gunong Tuhan, 3,000 ft. ♀ 55.2028 Kuala Teku, Tahan River, ♂ 55.2029, ♀ 55.2030 Triang, ♂ 55.2031 Benom foothills, Selangor: ♂ 55.2035 Kuala Lumpur, ♂ 55.2036, ♀ 55.2037 Klang Gates, ♂ 55.2038 Ulu Gombok, ♀ 55.2039 Cheras, Ulu Langat, ♀ 55.2040 Menang Gasing, Ulu Langat, ♀ ♀ 55.2041–2042 Tambok, Kuala Langat, ♀ 55.2403 Bukit Kutu, ♀ 55.2044 Ginting Bidai.

Malacea: ♂ 55.2032, ♀ ♀ 55.2033–2034 Nyallas.

Negri Sembilan: ♂ 55.2045 Ayer Kring, Negri Sembilan–Pahang border, ♂ ♂ 55.2046–2047 Bukit Tampin, ♂ 55.2048 Bukit Lantai.

Johore: ♀ 55.2049 Tanjung Gomuk, ♂ ♂ 55.2050–2052 Padang Tuun Segamat.

Trengganu: ♂ ♂ 55.2053–2054 Bukit Jong.

There is little individual colour variation in this large series, which covers the entire range of *C. n. miniatuus*. The black side stripes in a few specimens are more prominent than in the majority, but not so much so as in *C. n. singapurensis*. Measurements: head and body 171–224 (198) (fifty-seven skins), tail 170–203 (188) (fifty-four skins), condylobasal length 44.2–48.0 (45.9) and maxillary toothrow 8.9–9.9 (9.3) (fifty-two skulls in both instances).

#### *Callosciurus notatus peninsularis* (Miller)

Pahang: ♀ 55.2056 Kuala Sembrong, Endau.

Johore: ♂ 55.2055 Bentan, Sungai Bernbau.

These specimens may be readily distinguished from *C. n. miniatuus* by their more ochraceous underparts. The rufous tail tip is much reduced in both examples. Measurements of six specimens (except where stated) of *peninsularis*: head and body 189–220 (202), tail 178–207 (193) (five skins), condylobasal length 44.8–48.6 (46.4) and maxillary toothrow 9.1–10.4 (9.5).

#### *Callosciurus notatus singapurensis* (Robinson)

Singapore Island: ♀ 55.2057 Changi, ♀ 55.2058 Bukit Timah.

Two of the original series.

#### *Callosciurus notatus raptor* subsp. nov.

Type locality: Little Karimon Island, Riau Archipelago.

Type: ♂ 9.4.1.152. Skin and skull in good condition. Collected 30th August, 1908 by H. C. Robinson and E. Seimund. Collector's No. 1687.

Other material: ♂ 9.4.1.153, ♀ ♀ 9.4.1.154–156 (9.4.1.155 without skull). Little Karimon Island.

This race is closely related to *C. n. singapurensis* but may be distinguished from it by its smaller size and by the absence of a rufous tail tip.

The upperparts are a grizzle of grey and buff and are very slightly paler than in *singapurensis* while the forearms are ochraceous buff and are much paler than those of *singapurensis*. The outer surfaces of the thighs are tinged with buff and are paler than those of *singapurensis* while the well defined ocular ring of orange or orange yellow in this race is in *raptor* much reduced or absent. Tail without a rufous tip. Underparts orange or ochraceous orange as in *singapurensis*: the black side stripes slightly reduced and with an admixture of chestnut or tawny.

Measurements of the type specimen: head and body 196, tail 183, hindfoot 43, ear 16, greatest length of skull 47.8, condylobasal length 44.6, palatal length 25.5, maxillary toothrow 8.8, diastema 10.9, zygomatic width 28.0, postorbital width 17.2, interorbital width 16.8 and length and breadth of combined nasals  $14.5 \times 6.4$ .

Measurements of a small series of *raptor*: head and body 172–196 (182) (five specimens), tail 182–185 (183) (four specimens), condylobasal length 43.2–45.3 (44.4) and maxillary toothrow 8.8–9.5 (9.1) (four specimens in both instances). Of six specimens of *singapurensis*: head and body 190–212 (205), tail 175–224 (190), condylobasal length 45.1–46.9 (46.3) and maxillary toothrow 9.6–10.2 (9.9). *Callosciurus notatus nesiotes* (Batam Island) and *C. n. lunaris* (Bulan Island) are about the same size as *singapurensis* (condylobasal length in eleven examples of *nesiotes* 45.8–48.0 (46.5)) while *C. n. stellaris* (Bintang Island) is rather larger (condylobasal length in five specimens 47.7–49.6 (48.6)).

The name is an allusion to the piracy for which the islands of the Rhio Lingga Archipelago once formed a base.

Examples of all named forms of *Callosciurus notatus* from the Rhio Archipelago are now in the collection of the British Museum (Natural History), and, as noted by Chasen (1940), although all are very near to *peninsularis* (with the exception of *maporensis* (Pulau Mapor) which is a dwarfed form with a pale belly, closely resembling *C. n. pemangilensis* but with prominent side stripes) they divide into a number of weakly marked island races. In each case the characters marking island races from other parts of the Peninsula appear to a greater or lesser extent: replacement of the colour of the side stripes by that of the underparts and their reduction; the replacement of the orange of the underparts by yellow; the disappearance of the rufous tail tip and often a reduction of size. These processes, however, have not advanced as far in the Rhio Archipelago races as in island groups in other parts of the Peninsular region, i.e. the Johore Archipelago.

The races of *Callosciurus notatus* from the Rhio group apparently have not been compared with *C. n. rupatius* (Lyon) (Pulo Rupat, east coast of Sumatra) (Chasen (1940)). A male paratype of *rupatius* (9.3.29.6, formerly U.S. Nat. Mus. 143403) has the upperparts and the upper surface of the tail darker than in any of the Rhio forms, and nearest to *C. n. stellaris*; ventrally, this specimen is rufous orange and is more rufous than any of the Rhio races, especially over the inner surfaces of the thighs. Ventrally, the hairs of the tail are annulated with tawny buff and not buff or yellow buff as in the forms from the Rhio Archipelago. *Callosciurus notatus rupatius* is in general a darker, more heavily coloured form nearer to the Sumatran races of *Callosciurus notatus* than to those from the Rhio Archipelago.

#### *Callosciurus notatus maporensis* (Robinson)

Pulau Mapor, Riau Archipelago: ♂♂ 55.2161–2164.

#### *Callosciurus notatus pemangilensis* (Miller)

Pulau Pemanggil, Johore Archipelago: ♂♂ 55.2082–2087, ♀♀ 55.2088–2100.

Measurements of a series of *C. n. pemangilensis*: head and body 154–187 (179) (nineteen specimens), tail 138–164 (150) (eighteen specimens), condylobasal length 38.5–41.6 (40.4) (nineteen specimens) and maxillary toothrow 8.1–9.1 (8.6) (nineteen specimens).

***Callosciurus notatus aoris* (Miller)**

Pulau Aor, Johore Archipelago: ♂♂ 55.2101–2104, ♀♀ 55.2105–2110.

Measurements of a series of *C. n. aoris*: head and body 160–179 (171) (ten specimens), tail 152–168 (157) (eight specimens), condylobasal length 39.2–41.1 (39.9) (ten specimens) and maxillary toothrow 8.5–9.0 (8.7) (ten specimens).

***Callosciurus notatus famulus* (Robinson)**

Pulau Dayang, near Pulau Aor, Johore Archipelago: ♂ 55.2111, ♀ 55.2112.

*Callosciurus notatus pemangilensis* and *C. n. aoris* are closely similar in size and differ only in small details of colour: *C. n. famulus*, which is also about the same size as these races, differs sharply from them in its much more ochraceous orange underparts (which resemble those of *peninsularis*) and by the presence of a rufous tail tip as in *peninsularis*. Measurements of an adult male and (in parentheses) an adult female: head and body 185 (172), tail 165 (146), condylobasal length 41.9 (41.2) and maxillary toothrow 8.8 (8.7).

***Callosciurus notatus tinggius* subsp. nov.**

Type Locality: West side of Pulau Tinggi, Johore Archipelago.

Type: ♂ 55.2075. Skin and skull in good condition. Collected on 20th June, 1915 by H. C. Robinson. Collector's No. 6531 F.M.S. No. 519/15.

Other Material: ♂♂ 55.2069–2074, 55.2076, ♀♀ 55.2077–2081. West side of Pulau Tinggi.

This race is very similar to *C. n. peninsularis* of south-east Pahang but may be distinguished from it by its paler, more ochraceous underparts, paler back and by the absence of a rufous tail tip, which, although obsolescent, is present in *peninsularis*. The race may be distinguished from *C. n. subluteus* of south-east Johore by its slightly brighter underparts and paler back, which is more prominently grizzled with pale yellow or buff. The forearms, thighs, cheeks and head are paler and more ochraceous in *tinggius* than in *subluteus* and in this respect the race resembles *peninsularis*.

The upper parts and tail of the type are a grizzle of black and ochraceous buff. The hairs of the head, forearms and thighs are heavily tipped with buff or ochraceous, while the underparts are orange to ochraceous orange: the lateral stripes are reduced and are admixed with the colour of the underside to produce a chestnut or tawny colour (they are black in *peninsularis* and *subluteus*). The underside of the tail is heavily washed with ochraceous buff: over the series as a whole the majority of specimens have no trace of a rufous tail tip while in a minority this is represented by a few hairs annulated and tipped with ochraceous orange.

*Callosciurus notatus tinggius* forms a link between the dwarfed races *aoris*, *pemangilensis* and *famulus* from the Johore Archipelago and the mainland *peninsularis*. It may be distinguished from *pemangilensis* and *aoris* by its brighter underparts, more prominent side stripes and greater size and from *famulus* by its greater size and by the absence of a rufous tail tip. In *tinggius* the back is similar to that of the Johore Archipelago races while the underparts, like those of *famulus* (which apart from its size closely resembles *peninsularis*) retain the brighter tints of the mainland form. Reduction of the side stripes has begun in *tinggius* and the rufous tail tip of the mainland form has almost completely disappeared.

Measurements of the type specimen: head and body 209, tail 188, hindfoot 44, ear 16, greatest length of skull 50.8, condylobasal length 46.8, palatal length 25.7, maxillary

toothrow 9.3, diastema 11.6, zygomatic width 29.4, interorbital width 17.8 and length and breadth of the combined nasals  $13.7 \times 7.2$ .

Measurements of a series of *C. n. tigrinus*: head and body 190–209 (199) (ten specimens), tail 178–194 (187) (nine specimens), condylobasal length 44.2–46.8 (45.8) (nine specimens) and maxillary toothrow 9.3–10.0 (9.7) (nine specimens). Of six specimens of *subluteus*: head and body 181–191 (188), tail 180–199 (188), condylobasal length 45.5–48.0 (46.5) and maxillary toothrow 8.2–9.5 (9.0).

***Callosciurus notatus lighti* (Chasen and Kloss)**

Penang Island: ♂♂ 55.2059–2063, 55.2067 (skin only), ♀♀ 55.2064–2066, 55.2068 (skin only) Telok Balung.

These specimens were collected at the same time as the original series. They show very little reduction of the red element of the tail or of encroachment of the dark side stripes by the colour of the underside when compared with extensive material from the mainland. Measurements: head and body 175–200 (192), tail 175–211 (194) (nine specimens in both instances), condylobasal length 45.8–47.5 (46.5) (seven specimens) and maxillary toothrow 9.4–10.00 (9.7) (eight specimens).

***Callosciurus notatus tenuirostris* (Miller)**

Pulau Tioman, Pahang Archipelago: ♂♂ 55.2120–2125, 55.2126 (skin only), 55.2127, ♀♀ 55.2128–2139 Juara Bay, 55.2140 (skull only).

Dorsally, there is little colour variation over this series. Two specimens have a poorly defined rufous tip to the tail but in the majority this is represented by a few hairs at the tip of the tail annulated with orange red. There is considerable variation of colour on the underparts which range in colour from deep orange or orange red to a relatively pale ochraceous tinge.

***Callosciurus notatus watsoni* (Kloss)**

Lantinga Island, off Trengganu, Malay Peninsula: ♂ 55.2118, ♀ 55.2119.  
Two of the original series.

***Callosciurus notatus scotti* (Kloss)**

Little Redang Island, off Trengganu, Malay Peninsula: ♂ 55.2141.  
One of the original series.

***Callosciurus notatus plasticus* (Kloss)**

Great Redang Island, off Trengganu, Malay Peninsula: ♂♂ 55.2113–2115, ♀♀ 55.2116–2117.

Part of the original series. ♀ 55.2117 is an example of "Mutation 2" of Kloss (1911).

***Callosciurus notatus perhentianus* (Kloss)**

West Perhentian Island, off Trengganu, Malay Peninsula: ♂♂ 55.2142–2145, ♀♀ 55.2146–2148.

Part of the original series.

***Callosciurus notatus proteus* (Kloss)**

East Perhentian Island, off Trengganu, Malay Peninsula: ♂♂ 55.2149–2153, ♀♀ 55.2154–2160.

Part of the original series. ♂♂ 55.2149 and 55.2150 represent "Mutation 2" and "Mutation 3" of Kloss (1911), respectively.

***Callosciurus notatus dulitensis* (Bonhote)**

Sarawak: ♂ ♂ 55.833, 55.848–851, ♀ ♀ 55.834, 55.852–853 Sungai Pelandok, Paku, Sarebas. ♂ ♂ 55.838, 55.863, ♀ ♀ 55.839–844, 55.845 (skin only) Anyut, Paku, Sarebas. ♂ ♂ 55.854–855 Udan, Paku, Sarebas. ♀ ♀ 55.856–858 Balingean, Sarawak. ♂ ♂ 55.859–860, ♀ 55.861 (skin only) Bukar, Samarahan. ♀ 55.862 Mora Barue, Samarahan. 55.846–847 (skulls only). No precise locality.

Bornean *Callosciurus notatus* has hitherto been poorly represented in the collection of the British Museum (Natural History); no specimens of *dulitensis* are available for comparison (for a discussion on this race, see Chasen and Kloss (1931)). There is no topotypical *conspicuus* in the collection but a series collected by Shortridge in central and south central Borneo can be distinguished from the material listed above by its greyer, less brightly coloured dorsal surfaces, thighs and feet.

***Callosciurus notatus rutiliventris* (Miller)**

North Natuna Islands: ♂ 55.832 (skin only) Sedanau Island.

***Callosciurus nigrovittatus nigrovittatus* (Horsfield)**

1823 *Sciurus nigrovittatus* Horsfield, Zool. Rev. Java, 7. West Java [restricted by Kloss (1921)].

1831 *Sciurus griseiventer* Geoffroy, in Belanger, Voy. Indes Orient., 2: 147. West Java [restricted by Kloss (1921)].

1921 *Sciurus nigrovittatus besuki* Kloss, Journ. Fed. Mal. St. Mus., 10: 231. Tamansari, Idjen Massif, East Java, 1,600 ft.

West Java: ♂ ♂ 54.115–117, ♀ 54.118 Tjibodas, 4,000–5,000 ft. ♀ 54.119 Kandang Budak, Mount Gedeh, 7,900 ft. ♂ ♂ 54.125–127, ♀ 54.128 Oedjoengleboe, 1,000 ft. ♂ 54.129 Wynkoops Bay, 100 ft.

Middle Java: ♂ 54.122, ♀ ♀ 54.123–124 Karangbolang, 100 ft.

East Java: ♂ ♂ 54.105–107, ♀ ♀ 54.108–112 Sodong Jerok, Idjen Massif, 3,900 ft. ♂ 54.113, ♀ 54.114 Ongop Ongop, Idjen Massif, 5,700 ft. ♀ ♀ 54.120–121 Tamansari, 1,600 ft.

A series of specimens assembled from various localities in Java supports the view of Dammerman (1931) that there is no justification for the retention of the eastern race *besuki*. In the majority of specimens the grey colour of the belly extends over the throat; others from both east and west Java have an ochraceous or buffy suffusion on the throat which sometimes extends on to the anterior part of the chest. No consistent difference in brightness of colour on muzzle, sides of head and neck between eastern and western specimens can be detected in this series. Sody has named a number of races of *Callosciurus nigrovittatus* from Java which are unrepresented in the collection of the British Museum (Natural History). These are *madsoedi* (1929), *salakensis* (1949), *bantamensis* (1949), *phoenicurus* (1949) and *tenggerensis* (1949).

***Callosciurus nigrovittatus johorensis* (Robinson and Wroughton)**

Pahang: ♂ 55.2170 Bentong. ♂ 55.2173 Kuala Rompin. ♀ 55.2178 Triang.

Selangor: ♂ 55.2169 Menang Gasing, Ulu Langat. ♂ 55.2172 Cheras, near Kuala Lumpur. ♀ 55.2177 Gingting Bidai. ♀ 55.2179 Klang Gates.

Negri Sembilan: ♂ ♂ 55.2174–2175, ♀ 55.2176 Gunong Tampin, 1,000–1,200 ft.

Malacca: ♂ 55.2171 Nyalas.

Specimens from Kuala Rompin, Triang, Cheras, Ulu Langat, the Klang Gates, Gingting Bidai and Bentong can be distinguished from the more northerly *bilimitatus* only

in that the colour of the throat is slightly paler, not appreciably extending on to the chest in a median line and in that the underside of the tail is less brightly coloured.

**Callosciurus nigrovittatus bilimitatus (Miller)**

Perak: ♂ 55.2165 Ulu Selama. ♀ 55.2168 Maxwell's Hill, Taiping.

Pahang: ♂ 55.2166 Genting, Kuala Lipis.

Selangor: ♂ 55.2167 9th mile, Pahang Road, Kuala Lumpur.

This race, distinguished from the more southerly *johorensis* by its brighter, more rufous colouring on the face, neck, throat and the underside of the tail, was hitherto represented in the British Museum (Natural History) by three specimens from Bukit Besar and Telom River. 55.2167 is very slightly paler on the throat and the underside of the tail and approaches *johorensis*.

**Callosciurus nigrovittatus microrhynchus (Kloss)**

Pulau Tioman, Pahang Archipelago: ♂ ♂ 55.2180-2187, ♀ ♀ 55.2188-2191 Juara Bay.

This race differs only very slightly from *johorensis*: examples of the latter race from Johore exactly resemble *microrhynchus* in colour of the underside of the head and throat but those from localities further north generally have more ochraceous colour on these areas. *Callosciurus nigrovittatus microrhynchus*, however, may be distinguished from *johorensis* by its greyer tail, which has little of the yellow tinge found in *johorensis* and by its slightly smaller size. Measurements of twelve skins of *microrhynchus*: head and body 178-206 (187), tail 113-177 (153). Of eleven skulls (except where stated): condylobasal length 41.2-44.9 (42.8), zygomatic width 27.6-29.7 (28.4) (eight skulls), maxillary toothrow 9.0-9.7 (9.3), greatest length of nasals 14.1-15.2 (14.7) and greatest width of nasals 6.7-7.9 (7.2). Measurements of fifteen skins of *johorensis*: head and body 185-210 (195), tail 116-182 (161). Of fourteen skulls (except where stated): condylobasal length 42.9-45.9 (44.4), zygomatic width 28.5-31.2 (29.8) (twelve skulls), maxillary toothrow 9.3-9.9 (9.5), greatest length of nasals 13.2-15.5 (14.7) and greatest width of nasals 6.6-7.7 (7.1).

**Callosciurus nigrovittatus orestes (Thomas)**

Sarawak: ♂ 55.828, ♀ 55.829, 55.830 (skin only) Mount Dulit, ♀ 55.827, 55.831 (skull only). No exact locality.

**Callosciurus melanogaster melanogaster (Thomas)**

Mentawi Islands, west Sumatra: ♂ 28.II.2.6 Sipora Island.

**Callosciurus melanogaster mentawi (Chasen and Kloss)**

Mentawi Islands, west Sumatra: ♂ 28.II.2.5 (the type specimen) Siberut Island.

**Callosciurus hippocurus hippocurus (Geoffroy)**

Peninsular Siam: ♀ 55.2292 (skin only) Lam-ra, Trang. ♂ 55.2302 Kao Nong, Bandon, 1,200-1,500 ft.

Perak: ♂ 55.2294 Ulu Selama. ♂ 55.2296. ♀ 55.2297 Runuk Tanjung. ♂ 55.2308 Maxwell's Hill, 4,000 ft.

Pahang: ♀ 55.2298 Kuala Teku, Tahan River. ♀ 55.2303 Bukit Bangkong, Rompin. ♂ 55.2304 Bentong.

Selangor: ♂ 55.2305 Rawang. ♀ 55.2306 Bukit Fraser, above Semangko Pass, 4,000 ft. ♂ 55.2307 Klang Gates.

Negri Sembilan: ♂ 55.2293 Bukit Tangga, ♀ v 55.2300–2301 Ayer Kring. ♂ 55.2295 Tanjong Tuan.

Johore: ♂ 55.2299 Padang Tuan, Segamat.

**Callosciurus hippocurus hippurellus (Lyon)**

Sarawak: ♀ 55.812 Gunong Sidong, Samarahan.

This specimen agrees well in colour with one from Mount Penrisen (mentioned by Thomas (1892) in the description of *C. h. pryeri*). The race appears to be distributed along most of the west coast of Borneo. Both this specimen and that from Mount Penrisen have a few orange tipped hairs at the tip of the tail.

**Callosciurus hippocurus grayi (Bonhote)**

1867 *Macroxus infugaster* var. *borneensis* Gray, Ann. Mag. nat. Hist., 20: 283. Sarawak.

1901 *Sciurus hippocurus grayi* Bonhote, Ann. Mag. nat. Hist., 7: 71, footnote: *nom. nov.*.

Sarawak: ♂ 55.813, ♀ 55.814 Balingean.

Chasen (1940) used *borneensis* Gray for this race; this name, however, is preoccupied in the genus *Callosciurus* by *borneensis* Müller and Schlegel (in Temminck, Verh. nat. gesch. Ned. overz. bezitt. Zool. 1844: 86), a member of the *prevosti* group.

**Callosciurus tenuis tenuis (Horsfield)**

Kedah: ♂ ♂ 55.2224–2226, ♀ 55.2227–2228 Kedah Peak, 3,000 ft.

Trengganu: ♀ ♀ 55.2222, 55.2223 (skin only) Bukit Jong.

Dindings: ♂ ♂ 55.2239–2230, ♀ 55.2231 Tanjung Hantu.

Perak: ♀ ♀ 55.2232–2233 Telom, Perak–Pahang boundary, 3,500 ft. ♂ 55.2234 Batu Tegor, near Taiping Hill. ♂ 55.2235, ♀ 55.2236 Changkat Mentri. ♂ 55.2238, ♀ 55.2239 Temengoh. ♂ 55.2240 Ulu Sekama, ♀ 55.2243 Gunong Kerbau. ♂ 55.2237 Perak. 55.2241 (skull only). No precise locality.

Pahang: ♂ ♂ 55.2209–2210, ♀ 55.2211 Kuala Teku, Tahan River. ♂ ♂ 55.2212–2213, ♀ 55.2214 Kuala Tahan. ♀ 55.2215 Gunong Tahan. ♀ 55.2216 Benom foothills. ♀ 55.2217 Wray's Camp, Gunong Tahan, 3,000 ft. ♂ 55.2218 Gunong Sinyum, 1,595 ft. ♂ 55.2219 Genting, Kuala Lipis. ♂ 55.2220 Punyam, Kuala Lipis. ♀ 55.2221 Bentong.

Selangor: ♂ ♂ 55.2202–2205. ♀ 55.2206 Ginting Bidai, 1,000–2,300 ft. ♂ 55.2207 Klang Gates. ♀ 55.2208 Rawang, west of railway, near mines.

Negri Sembilan: ♂ 55.2242 Bukit Lantai. ♂ 55.2195 Ayer Kring. ♂ ♂ 55.2196–2197, ♀ ♀ 55.2198–2199 Gunong Tampin, 1,000–2,700 ft. ♀ ♀ 55.2200–2201 Bukit Tangga, 1,300 ft.

Singapore Island: ♂ 55.2192, ♀ ♀ 55.2193–2194 Changi.

There is little colour variation in this long series, which covers most of the range of *C. t. tenuis*. Measurements of forty-six skins and forty-one skulls: head and body 120–155 (135), tail 94–124 (111), condylobasal length 31.8–35.1 (33.3) and maxillary toothrow 6.4–7.4 (6.9).

**Callosciurus tenuis surdus (Miller)**

Peninsular Siam: ♀ 55.2244, Chong Trung, 250 ft. ♀ 55.2245 Khao Ram, 1,200 ft. ♂ 55.2246 Gap, Patelung. ♂ 55.2248, ♀ 55.2249 Khao Luong, Nakon Sri Thammarat, 2,000 ft.

Perak: ♀ 55.2247 Lenggong.

Measurements of six skins and three skulls: head and body 126–142 (136), tail 102–123 (109), condylobasal length 32.9–34.0 (33.6) and maxillary toothrow 6.6–7.1 (6.9).

***Callosciurus tenuis* gunung (Robinson and Kloss)**

Peninsular Siam: ♀ ♀ 55.2250-2251 Kao Nong, Banden, 3,500 ft.  
Two of the original series.

***Callosciurus tenuis* tahan (Bonhote)**

Perak: ♂ ♂ 55.2252-2253, ♀ ♀ 55.2254-2255 Gunong Ijan, 4,700 ft. ♀ 55.2256 Maxwell's Hill, Taiping, 4,000 ft.

Pahang: 55.2271 Teku Plateau, Gunong Tahan, 5,000-6,000 ft. ♂ 55.2272 Wray's Camp, Gunong Tahan, 3,000 ft.

Selangor: ♀ ♀ 55.2257-2260 Menang Gasing, 3,000-4,900 ft. ♂ 55.2261 (skin only), 55.2262 (skin only) Gunong Mengkuang Lebar, 4,800 ft. ♂ ♂ 55.2263-2264 Bukit Kutu, 3,400 ft. ♂ 55.2265, ♀ 55.2266 Ginting Bidai, 1,800 ft. ♂ 55.2267, ♀ ♀ 55.2268-2269 Semangko Pass, Selangor-Pahang boundary, 2,700 ft. ♀ 55.2270 Bukit Fraser, above Semangko Pass, 4,000 ft.

Measurements of twenty skins and eighteen skulls: head and body 140-182 (160), tail 120-152 (133), condylobasal length 37.6-40.5 (38.8) and maxillary toothrow 8.0-8.6 (8.3).

***Callosciurus tenuis* tiomanicus (Robinson)**

Pulau Tioman, Pahang Archipelago: ♂ ♂ 55.2273-2275, ♀ ♀ 55.2276-2278 Juara Bay.

Part of the original series.

***Callosciurus tenuis* parvus (Miller)**

Sarawak: ♂ ♂ 55.795-796, ♀ 55.797 Ulu Paku, Sarebas. ♂ 55.809, ♀ ♀ 55.810-811 Anyut, Paku, Sarebas. ♂ ♂ 55.798-799, ♀ 55.800 Mount Dulit, Baram, 3,000-3,400 ft. ♂ ♂ 55.801-803 Gunong Sidong, Samarahan, 1,200 ft. ♂ ♂ 55.804-805, ♀ 55.806 Bukur, Samarahan. ♀ ♀ 55.807 (skin only), 55.808 Entawa, Samarahan.

There is little colour variation in a series from a number of localities in Sarawak. Males collected in October—January are frequently more than usually rufous on the shoulders and have a strong infusion of yellow orange or orange in the inguinal region. Measurements of fifteen skulls and thirteen skulls: head and body 127-167 (148), tail 115-135 (126), condylobasal length 33.1-36.8 (35.3) and maxillary toothrow 7.1-7.7 (7.3).

***Callosciurus brookei* (Thomas)**

Sarawak: ♂ ♂ 55.815-817, ♀ ♀ 55.818-819 Mount Dulit, Baram, 3,200-3,500 ft.

***Callosciurus lowi* lowi (Thomas)**

Sarawak: ♂ 55.820, ♀ ♀ 55.821-823 Mount Dulit, Baram, 3,400 ft. ♂ 55.824 Gunong Sidong, Samarahan, 1,200 ft. ♂ ♂ 55.825-826 Bukur, Samarahan.

***Callosciurus lowi robinsoni* (Bonhote)**

Peninsular Siam: ♀ 55.2279 Tasan, Chumphuwn, ♀ 55.2280 Kao Nong, Banden. Perak: ♂ 55.2281 Temengoh, ♀ 55.2282 Changkat Mentri.

Pahang: ♂ 55.2286 Tring, ♀ 55.2291 Kuala Teku.

Selangor: ♂ 55.2283, ♀ 55.2284 Ginting Bidai, 1,800 ft. ♂ 55.2285 Rawang, ♂ 55.2287, ♀ 55.2288 Klang Gates.

Negri Sembilan: ♂ 55.2289, ♀ 55.2290 Ayer Kring.

**Menetes berdmorei berdmorei (Blyth)**

Peninsular Siam: ♂ ♂ 55.2309–2310, ♀ ♀ 55.2311–2312 Nongkok, Grabi (=Krabi), ♀ 55.2313 Tasan, Chumpawn, 220 ft. ♂ 55.2314 Tap-li, Pakchan, ♂ 55.2315 Renong River.

Pulau Panjang, off west coast Peninsular Siam: ♂ 55.2316, ♀ 55.2317 Teluk Poh. Junk Seylon, off west coast Peninsular Siam; ♂ 55.2318, ♀ 55.2319 Telok Pales, Tongku, ♂ 55.2320 Klong Tun Sai, Tongku.

Although referred to *M. b. berdmorei*, in some respects these specimens are intermediate between that race and *M. b. peninsulae* from Bandon. Compared with typical and topotypical material of *peninsulae* they are slightly paler, especially on the head, and their colour is less intense between the dorsal stripes, the central one of which is more diffuse than in *peninsulae*. The material listed above, which is mainly from the west coast of Peninsular Siam, closely resembles two specimens from Klong Bun Lai, Patiyu (Kloss (1916: 23)) and others from Sullivan Island and Kisseraing Island, Mergui Archipelago. A series of *M. b. berdmorei* in the British Museum (Natural History) shows that animals from the western coast of Peninsular Siam, extreme south Tenasserim and the Mergui Archipelago are darker and more olivaceous dorsally than those from central Tenasserim and Burma. The dorsal stripes are more prominent in southern specimens, and the intervals between the stripes are more brightly coloured. Northern specimens are nearer to *M. b. consularis* and have the mid-dorsal and side stripes much reduced and in some cases obsolete. Such specimens are only very slightly darker above than typical *consularis*.

**Menetes berdmorei peninsulae Robinson and Kloss**

Peninsular Siam: ♂ 55.2321, ♀ ♀ 55.2322–2324 Ban Kok Klap, Bandon, 50 ft. These specimens are part of the original series.

**Menetes berdmorei consularis Thomas**

Peninsular Siam: ♀ 55.2325 Koh Lak, Raiburi.

*Menetes berdmorei consularis* was tentatively synonymised with *M. b. mouhoti* by Ellerman and Morrison-Scott (1951). A good series of skins, however, suggests that *consularis* is not synonymous: it is a pallid race with no trace of a median dorsal stripe, ranging from the eastern parts of Tenasserim and Burma through north, central and Peninsular Siam into Cambodia and northern Cochin China. Specimens from Tay-ninh, Cochin China and Angkor, Cambodia lack a median dorsal stripe: others from Kon-tohn, Annam, Dak-to, Annam and An-Binh, Cochin China have a narrow dorsal stripe and are slightly darker dorsally. These tend towards *M. b. mouhoti*, a darker, more brightly coloured race, ranging from south-east Siam into southern Cambodia, southern Cochin China and southern Annam.

**Lariscus insignis jalorensis (Bonhote)**

Peninsular Siam: ♂ 55.2350 Kao Nong, Bandon, 1,200–1,500 ft.

Perak: ♀ 55.2347 Changkat Mentri, ♂ 55.2348, ♀ 55.2349 Bukit Pudang, ♀ 55.2351 Johor, ♂ 55.2353 Parit, ♂ 55.2354 (skin only), ♀ ♀ 55.2355–2356, 55.2357 (skin only) Runuk Tanjong, ♂ 55.2358 Telom, 3,500 ft. 55.2359 (skin only) Tanjong Malim. ♂ ♂ 55.2385–2388, 55.2389–2390 Batu Tegor, Taiping.

Pahang: ♀ ♀ 55.2363–55.2364 (skin only) Benom foothills. ♀ 55.2365 Kuala Teku, Tahan River. ♀ 55.2366 Bukit Fraser, above Semangko Pass, 4,000 ft. ♂

55.2367, ♀ 55.2368 (skull only) Triang, Pahang. ♀ 55.2373 Punyum, Kuala Lipis. ♂ 55.2384 Genting, Kuala Lipis.

Selangor: ♀ 55.2374 Gunong Mengkuang Lebar, 4,800 ft. ♂ 55.2375 Rawang, west of the railway, near mines. ♂ 55.2376 Rantau Ranjang, Rawang.

Negri Sembilan: ♂ 55.2377, ♀ 55.2378-2379 Ayer Kring. ♂ 55.2380, ♀ 55.2381-2382 Bukit Tangga, 1,300-1,400 ft.

Malacca: ♂ 55.2383 Nyulas.

Specimens from Malacca, Negri Sembilan and the southern parts of Selangor and Pahang are more reddish on the back, flanks and thighs than those from more northerly localities and tend towards *L. i. meridionalis*.

#### **Lariscus insignis fornicateus Robinson**

Pulau Tioman, Pahang Archipelago: ♂ 55.2391 Juara Bay.

One of the original series.

#### **Lariscus insignis diversus (Thomas)**

Sarawak: ♀ 55.864-865 Anyut, Paku, Saribas. ♂ 55.866 Ulu Paku, Saribas. ♂ 55.867-868 Gunong Sidong, Samarahan. ♂ 55.869. ♀ 55.870 Entawa Samarahan.

In general, this material agrees closely with the type but specimens from Gunong Sidong (collected in October) have the belly and the inside of the thighs strongly washed with rufous.

#### **Lariscus insignis javanicus (Thomas and Wroughton)**

West Java: ♂ 54.135, ♀ 54.136 Tjibodas, 5,000 ft. ♂ 54.137, ♀ 54.138-139 Wynkoops Bay, 100 ft.

In Java, *Lariscus insignis* has been divided into three races, *javanicus*, *vulcanus* and *muranicus*. The latter is not represented in London. On the evidence of a small series from various localities in Java I am inclined to agree with Dammertman (1931) that *vulcanus* cannot be separated on grounds of colour. Kloss diagnosed the race on one character: "hairs of tail tipped with buff or tawny instead of white". Sody (1949) adds that the maxillary toothrow is shorter in *vulcanus*. A specimen from Tjibodas has white hair tips at the proximal and central parts of the tail and buffy tips at the end; another from Cheribon has almost no white tipped hairs in the tail. One from Tamansari has a buffy tail with a few white tipped hairs at the sides while another from Tji Wangie, Preanger also has the tail hairs predominantly tipped with buff. The colour of the underside varies considerably in the series but in general specimens from east Java are more ochraceous beneath than those from west Java (which have ochraceous or orange colours confined to the sides of the throat, flanks and inside of the hind legs and which are otherwise grey) but the difference is very small and by no means regular. Specimens from the Idjen Massif, however, average somewhat smaller than those from west and central Java and on this ground are here referred to *L. i. vulcanus*.

Measurements of specimens from west and central Java (seven specimens unless otherwise stated): head and body 185-220 (192), tail 107-120 (112) (four specimens), condylobasal length 44.1-47.5 (45.9) (six specimens), palatal length 25.3-27.5 (26.5), maxillary toothrow 9.5-10.0 (9.8), zygomatic width 27.0-28.4 (27.8) and diastema 12.3-13.6 (12.9).

**Lariscus insignis vulcanus Kloss**

East Java: ♀ 54.130 Sodong Jerok, Idjen Massif, near Banjewangie, 3,900 ft. ♂ ♂ 54.131–133, ♀ 54.134 Ongop Ongop, Idjen Massif, 5,700 ft. ♀ 54.140 Tamansari, 1,600 ft.

Measurements of specimens from the Idjen Massif (six specimens unless otherwise stated): head and body 167–195 (183), tail 105–122 (114), condylobasal length 43.7–45.1 (44.5) (five specimens), palatal length 23.8–25.2 (24.5) (five specimens), maxillary toothrow 9.1–9.7 (9.3) (five specimens), zygomatic width 27.0–28.8 (27.5) (four specimens) and diastema 11.8–12.5 (12.3).

**Lariscus insignis siberu Chasen and Kloss**

Mentawi Islands, west Sumatra: ♂ 28.11.2.7 (the type specimen) Siberut Island.

**Dremomys rufigenis rufigenis (Blanford)**

Peninsular Siam: ♀ 55.2392 Tusun, Chumpawn.

This specimen can only be referred provisionally to *D. r. rufigenis*. Chasen (1940: 147, footnote) refers to a lighter coloured race occurring in the extreme north of Peninsular Siam which he allocates (without direct comparison of specimens) to *rufigenis*. This specimen, compared with *rufigenis*, is paler dorsally, the hairs having ochraceous buff tips. The feet are redder and the throat is whiter with no trace of buffy staining. Dorsally, the hairs of the tail are liberally tipped with silvery white, much as in *belfieldi*. The ear patch is white as in this race (a character of little importance according to Robinson and Kloss (1915)).

**Dremomys rufigenis belfieldi (Bonhote)**

Peninsular Siam: ♀ 55.2393 Kao Nong, Bandon, 3,500 ft. ♂ 55.2394 Khao Lueng, Nakon Sri Thammarat, 3,000 ft.

Pahang: ♀ 55.2395 Perak-Pahang boundary, 3,500 ft. ♂ ♂ 55.2398–2399 Bukit Fraser, above Semangko Pass, 4,000 ft.

Selangor: ♂ 55.2396, ♀ 55.2397 Gunong Mengkuang Lebar, 4,800 ft.

**Rhinosciurus laticaudatus tupaioides Blyth**

Peninsular Siam: ♂ 55.2400, ♀ 55.2401 Nongkok, Grabi (=Krabi). ♀ 55.2402 Tusun, Chumpawn, 220 ft. ♂ 55.2403, ♀ ♀ 55.2404–2405 Ban Kok Klap, Bandon, 50 ft.

Perak: ♂ ♂ 55.2406–2407 Parit. ♂ 55.2408. ♀ 55.2409 Runuk Tanjong.

Pahang: ♂ ♂ 55.2410–2411 Benom foothills. ♂ 55.2412. ♀ 55.2413 Kuala Tahan. ♂ 55.2414 Gunong Sinyum, 1,595 ft.

Selangor: ♀ 55.2415 Rantau Panjang Rawang ♀ 55.2416 Rawang, west of the railway, near mines. ♂ 55.2417 Klang Gates, 800 ft. ♀ 55.2418 Ginting Bidai, 2,300 ft.

Negri Sembilan: ♀ 55.2419 Bukit Tangga, 1,400 ft. ♂ 55.2420. ♀ 55.2421 Ayer Kring.

**Rhinosciurus laticaudatus leo Thomas and Wroughton**

Singapore Island: ♂ 55.2422 Changi.

**Rhinosciurus laticaudatus robinsoni Thomas**

Pulau Tioman, Pahang Archipelago: ♂ ♂ 55.2423–2425, ♀ 55.2426 Juara Bay. ♀ 55.2427.

**Tamiops melellandi novemlineatus (Miller)**

Tenasserim: ♂ 55.2328 Victoria Point.

Peninsular Siam: ♂ 55.2326 (no skull), ♀ 55.2327 Khao Luong, Nakon Sri Tamarat, 2,000 ft. ♀ 55.2329 Marmok, Pakchan. ♂ ♂ 55.2330-2331 Tap-li. ♀ 55.2332 Kao Nong, Bandon, 1,200-1,500 ft.

Perak: ♂ 55.2333, ♀ 55.2334 Gunong Ijau, 4,000-4,500 ft. ♀ 55.2335 Maxwell's Hill, 3,500 ft. ♂ 55.2336 Telom, 3,500 ft.

Pahang: ♂ 55.2337 Semangko Pass, Selangor-Pahang boundary, 2,700 ft. ♂ 55.2338, ♀ ♀ 55.2339-2340 Bukit Fraser, above Semangko Pass, 4,000 ft.

Selangor: ♂ 55.2341, ♀ 55.2342 Ginting Bidai, 1,800-2,300 ft. ♂ ♂ 55.2343-2344, ♀ 55.2345 Gunong Mengkuang Lebar, 4,800 ft.

Specimens from the northern part of Peninsular Siam and extreme south Tenasserim are referred to this race because of their slightly smaller skulls, smaller bullae and because the hairs of the white ear tuft have little black at the base when compared with *T. m. barbei* from Tenasserim and Burma. This race, which is very close to *barbei*, therefore extends into the Palaeartic Region as defined by Ellerman and Morrison-Scott (1951).

**Tamiops melellandi barbei (Blyth)**

Peninsular Siam: ♂ 55.2346 Hat Sanuk, near Koh Lak, Raiburi.

**Rheithrodontomys macrotis (Gray)**

Sarawak: ♀ 55.765 Ulu Paku, Sarebas. ♂ 55.766 Ulu Anyut, Paku, Sarebas. ♀ 55.767 Mount Dulit, Baram.

**Nannosciurus melanotis borneanus Lyon**

Sarawak: ♂ 55.871 Mount Dulit, Baram. ♂ 55.872 Ulu Paku, Sarebas. ♂ ♂ 55.873-874 Gunong Sidong, Samarahan. ♀ 55.875 Entawa, Samarahan.

**Nannosciurus whiteheadi (Thomomys)**

Sarawak: ♂ 55.876, ♀ ♀ 55.877-878 Mount Dulit, Baram, 3,400-3,500 ft.

**Nannosciurus exilis exilis (Müller)**

Sarawak: ♂ ♂ 55.879-880, ♀ 55.881 (skin only) Paku, Sarebas. ♀ 55.883 Anyut, Sarebas. ♀ 55.882 Bukar, Samarahan.

**Rattus rattus diardi (Jentink)**

Perak: ♂ 55.2930 Rungkup Estate, Bagan Datoh.

Penang Island: ♂ 55.2931, ♀ 55.2932 (skin only) Telok Bahang.

Selangor: ♀ 55.2934 Museum Quarters, Kuala Lumpur. ♂ 55.2933 Semangko Pass, Selangor-Pahang boundary, 2,700 ft. ♀ 55.2935 Klang Gates. ♀ 55.2936 Tanjong Karang, near Kuala Selangor. ♀ 55.2937 Ampang, Selangor. ♀ 55.2944 Pulau Angsa, off Selangor coast.

Johore: ♂ ♂ 55.2938-2939, ♀ ♀ 55.2940-2941 Tanjong Serat.

Singapore Island: ♀ 55.2942 Ponggol. ♂ 55.2943 Cavanagh Road.

Sarawak: ♀ ♀ 55.884-886 (skins only) Sungai Pelendok, Paku, Sarebas. ♀ 55.887 (skin only) Anyut, Paku, Sarebas.

East Java: ♀ 54.141 Sodong Jerok, Idjen Massif, near Banjoewangi, 3,900 ft.

West Java: ♀ 54.142 Tjiomas, 1,000 ft.

Christmas Island, Indian Ocean: ♀ 55.3186.

This series of the Malayan House Rat conforms accurately to the analysis of the form by Chasen (1933a). Measurements of fourteen specimens from the Malay Peninsula: head and body 163–216 (188), tail 162–231 (201), occipitonasal length 40.5–45.6 (43.0), condylobasal length 38.6–43.6 (40.9) and maxillary toothrow 6.7–7.5 (7.1).

**Rattus rattus argentiventer** (Robinson and Kloss)

1916 *Epimys rattus argentiventer* Robinson and Kloss, Journ. Strs. Br. Roy. Asiat. Soc. No. 73: 274. Pasir Genting, west coast of Sumatra.

1918 *Rattus rattus brevicaudatus* Horst and De Raadt, Zool. Meded. 4: 69. Java.

1921 *Rattus rattus bali* Kloss, Tropibia, 2: 123. Bali.

(?) 1941 *Rattus rattus chaseni* Sody, Tropibia, 18: 269. Krian, Perak, Malay States.

Kedah: ♀ 55.3147. Kedah Peak, 3,000 ft.

Perak: ♂ 55.3146 Maxwell's Hill, Larut, 3,500 ft.

Selangor: ♂ 55.3145 Cheras, near Kuala Lumpur.

Sarawak: ♀ ♀ 55.888–889 Sungai Pelandok, Paku, Sarebas. ♀ 55.890 Balingean.

East Java: ♂ ♂ 54.143–146, ♀ 54.147 Badjoelmati, 100 ft.

Specimens from Java, all of which except 54.146 are young adults with barely worn teeth, closely resemble the type dorsally but ventrally are whiter, only two, 54.143 and 54.145, showing any considerable suffusion of grey on the underparts. Javan material has the feet slightly paler than those of the type. Ventrally, all show indications of a darker gorget and median line. Specimens from Sarawak are identical with the type ventrally but dorsally are less coarsely grizzled with black and buff. The size differences used by Sody (who employed the measurements listed by Chasen (1933a) and one specimen from Chasen's series) do not apply to two adult specimens from the Malay Peninsula which are in close agreement with the type of *argentiventer* in both size and colour, although together with the type specimen of *chaseni* they lack much of the pale grey found on the underparts of the type of *argentiventer* (see also Harrison (1957)). For the present, therefore, I have retained *argentiventer* for the Peninsular form, pending the examination of a large series. Measurements of four adults from Java and Borneo: head and body 156–176 (167), tail 152–194 (167), occipitonasal length 39.6–41.2 (40.5), condylobasal length 38.0–39.5 (38.8) and maxillary toothrow 7.0–7.3 (7.2). Measurements of an adult male and female (in parentheses) from the Malay Peninsula: head and body 200 (185), tail 175 (172), occipitonasal length 43.7 (40.8), condylobasal length 42.2 (38.5) and maxillary toothrow 7.8 (7.6).

**Rattus rattus jalorensis** (Bonhote)

Kedah: ♂ 55.2947 Kedah Peak, 3,000 ft.

Perak: ♂ 55.2945 Temengoh, ♀ 55.2952 Batu Tegor, near Taiping Hill.

Dindings: ♂ 55.2948, ♀ 55.2949 Tanjung Hantu. ♂ 55.2950, ♀ 2951 Pulau Pangkor Besar.

Penang Island: ♂ 55.2956, ♀ 55.2957 Telok Bahang.

Trengganu: ♂ 55.2946 Bukit Jong.

Pahang: ♀ 55.2960 Labau Chindong, Rompin. ♂ 55.2961 Labong Endau.

Selangor: ♂ ♂ 55.2953–2954 Kuala Lumpur. ♂ 55.2955 Cheras, near Kuala Lumpur. ♂ 55.2959 Bukit Fraser, above Semangko Pass, Selangor-Pahang boundary, 4,000 ft.

Negri Sembilan: ♀ 55.2958 Gunong Tampin. ♂ 55.3189 Tanjong Tuan.

Pulau Berhala, Straits of Malacca: ♂ 55.2962, ♀ ♀ 55.2963–2964.

*Rattus rattus jalorensis* is fully described by Chasen (1933a). There is some variation in dorsal colour, most specimens having the back dull in colour, while a minority have the back brighter and more rufous, especially over the rump. Such specimens were referred to *R. r. rufescens* (Gray) by Berhote (1903). This series, like that examined by Chasen, displays wide variation in occipitonasal length, the maximum value for this measurement in twenty-three adult skulls being 18.3 per cent above the minimum. However, there is no evidence to support the view that a smaller form, *jalorensis*, in the Malay Peninsula, differs from a larger form, "*rufescens*" in darker back, black feet and shorter tail and ear, a conclusion also arrived at by Chasen from the examination of a similar series. The ventral surface varies from white through a dirty cream colour to white clouded with grey, and is sharply demarcated at the flanks. Three specimens from Pulau Berhala possess no characters differentiating them from *jalorensis* of the mainland. Measurements of nineteen skins and twenty-three skulls: head and body 143–170 (158), tail 160–198 (173), occipitonasal length 37.1–43.9 (39.8), condylobasal length 35.2–41.4 (37.9) and maxillary toothrow 6.1–7.1 (6.7).

#### *Rattus rattus jalorensis* $\times$ *tikos*

Peninsular Siam: ♀ 55.2965 Krong Mun, Trang. ♀ 55.2966 Khao Ram, 1,200 ft. ♂ 55.2967 Ban Kok Klap, Bandon. ♂ 55.2968 Ko-Khau, Trang. ♀ 55.2969 Tap-li (Klong Wan), Pakchan. ♂ 55.2970 (skin only), ♀ 55.2971 (skin only) Kok Lak, Raiburi. ♂ ♂ 55.2972–2974 (skins only) Nongkok, Ghirbi.

Junk Seylon, off west coast Peninsular Siam: ♂ 55.2975 Telok Pales.

As suggested by Chasen (1933a) this seems a convenient method of designating rats of the *jalorensis* type occurring in the Malay Peninsula from about 8° N. north to southern Tenasserim on the western side of the Peninsula and to Koh Lak (or perhaps further north) on the eastern coast. They cannot be referred to *jalorensis* for although they are variable in size their tails consistently average longer and the majority (especially those from the northern part of this area) are much brighter in colour dorsally than the dull *jalorensis* from that part of the Peninsula south of about 7° N. As far as can be established (a number of the skulls are missing) this series conforms closely to that examined by Chasen. Specimens from Bandon, Patiyu, Pakchan and Koh Lak have the black element in the dorsal pelage much reduced when compared with *jalorensis* and the grey based hairs are tipped with ochraceous rather than the brownish tipping of the latter race. Those from Ghirbi and Trang are duller, and are nearer to *jalorensis* but those from Ghirbi are larger than *jalorensis*. Specimens from Koh Lak and the mainland immediately adjacent are exceptionally long-tailed, a point also noted by Chasen (1933a). Measurements of four skins from Koh Lak, Pakchan and Patiyu: head and body 164–171 (167), tail 194–217 (209). Of three skins from Ghirbi: head and body 158–178 (170), tail 173–200 (190). Of four skins from Bandon and Trang: head and body 161–181 (171), tail 167–194 (180).

#### *Rattus rattus roquei* Sody

East Java: ♂ ♂ 54.148–150, ♀ ♀ 54.151–154 Tamansari, 1,600 ft.

Middle Java: ♂ ♂ 54.155–157 Karangbolang, 100 ft.

West Java: ♂ ♂ 54.158–159 Wynkoops Bay, 100 ft. ♀ 54.160 Oedjoengteboe; 1,000 ft.

Dammerman (1938) synonymised *Rattus rattus roquei* with *Rattus rattus jalorensis* of the Malay Peninsula. These specimens, however, are rather larger than the series of

*jalorensis* examined above, and, in particular, have a much longer tail. Measurements of thirteen skins and twelve skulls: head and body 150–190 (170), tail 192–222 (204), occipitonasal length 39.7–45.0 (41.7), condylobasal length 37.8–42.1 (39.0) and maxillary toothrow 6.9–7.7 (7.3).

**Rattus rattus batin** Robinson

Pulau Mapor, Riau Archipelago: ♂ 49.429 (the type specimen), ♂ 55.2976 Mentigi, west side of island. ♂ ♂ 55.2977–2978, ♀ ♀ 55.2979–2982.

The collection of the British Museum (Natural History) contains good series of *Rattus rattus* from the islands of the Riau Archipelago. Specimens from Pulau Bintang, Pulau Batam and Pulau Sau (a small island between Bintang and Batam) are much darker dorsally and average larger than *jalorensis* of the mainland. They are referable to *Rattus rattus rhinoris*. Measurements of eight skins and nine skulls: head and body 169–186 (179), tail 164–199 (181), occipitonasal length 40.4–44.6 (42.5), condylobasal length 39.6–42.3 (40.7) and maxillary toothrow 6.7–7.5 (7.1). Those from Pulau Kundur, Pulau Karimon, Little Karimon Island, Pulau Merah (near Pulau Karimon) and Tulang Island are referable to *Rattus rattus kunduris*. They are larger than *jalorensis* of the mainland, and are darker dorsally, with longer, harsher pelage. Ventrally, they are creamy white or white, sometimes faintly sullied with grey. Some variation in colour and size occurs between specimens from different islands. Specimens from Little Karimon are slightly paler above than those from Kundur and Karimon and have the dorsal pelage and the flanks rather more coarsely streaked with ochraceous, while a small series from Pulau Merah, although closely similar to topotypes in colour, has the dorsal pelage slightly shorter and less liberally sprinkled with long dark brown hairs. Measurements of series from the various islands:

*Pulau Kundur*: head and body 156–185 (173) (seven skins), tail 176–195 (186) (five skins), occipitonasal length 41.8–46.8 (43.9), condylobasal length 40.3–44.5 (42.2) and maxillary toothrow 6.9–7.6 (7.2) (seven skulls in each instance).

*Pulau Karimon*: head and body 152–183 (167) (twenty-six skins), tail 165–215 (188) (twenty-five skins), occipitonasal length 40.5–45.8 (43.2), condylobasal length 38.6–43.3 (41.2) and maxillary toothrow 7.0–7.5 (7.3) (twenty-seven skulls in each instance).

*Little Karimon Island* (eight specimens): head and body 150–167 (160), tail 162–208 (185), occipitonasal length 41.3–44.5 (43.0), condylobasal length 39.0–42.3 (40.9) and maxillary toothrow 6.9–7.6 (7.3).

*Pulau Merah* (six specimens): head and body 157–175 (163), tail 161–183 (175), occipitonasal length 40.5–42.7 (41.6), condylobasal length 40.0–41.2 (40.6) and maxillary toothrow 7.0–7.4 (7.1).

*Tulang Island* (adult male, female in parentheses): head and body 180 (180), tail 210 (181), occipitonasal length 47.0 (43.4), condylobasal length 45.2 (41.8) and maxillary toothrow 7.7 (7.4).

*Rattus rattus batin* (which is separated geographically from *kunduris* by the very much darker *rhinoris*) resembles *kunduris* (especially from Little Karimon Island) but is more reddish brown on the back and in colour shows an approach towards the mainland *jalorensis*. It differs from *jalorensis*, however, in greater average size, harsher pelage and a greater degree of development of the long black hairs on the lower back. Measurements of six skins and five skulls of *R. r. batin*: head and body 177–194 (185), tail 193–206 (202), occipitonasal length 41.4–44.0 (42.6), condylobasal length 39.7–41.5 (40.4) and maxillary toothrow 6.8–7.4 (7.1).

**Rattus rattus jarak** (Bonhote)

Pulau Jarak, Straits of Malacca: ♂♂ 55.2983-2991, 55.3001 (skin only), ♀♀ 55.2992-3000, 55.3002 (skin only).

Dorsally, *Rattus rattus jarak* is darker and has longer pelage than *jalorensis*. It is not as dark on the back as *rhinoris*, but is darker above than either *kunduris* or *batin*. The development of long black piles on the lower back is less marked in this race than in those from the Riau Archipelago. The underparts of these specimens are dirty white, occasionally stained with grey. They are part of the series measured by Robinson (1916). Measurements of twenty skins and seventeen skulls (except where stated): head and body 155-185 (168), tail 160-193 (177) (seventeen skins), occipitonasal length 38.5-42.1 (40.6), condylobasal length 37.2-39.9 (38.8) and maxillary toothrow 6.1-6.8 (6.5).

**Rattus rattus rumpia** (Robinson and Kloss)

Pulau Rumpia, Sembilan Islands, Straits of Malacca: ♂♂ 55.3004-3006, 55.3009-3010, ♀♀ 55.3007-3008.

*Rattus rattus rumpia* differs from *jarak* in its much large size, longer tail and slightly paler, more ochraceous dorsal colour, which in some specimens tends towards *jalorensis*. It differs from the latter race in greater size, longer tail and generally darker back. Measurements of fifteen specimens: (except where stated): head and body 169-201 (187), tail 199-233 (220) (fourteen skins), occipitonasal length 43.0-46.6 (45.0), condylobasal length 41.0-45.7 (43.2) and maxillary toothrow 7.2-7.9 (7.5).

**Rattus rattus** subsp.

Pulau Lalang, Sembilan Islands, Straits of Malacca: ♂ 55.3011, ♀ 55.3012-3013.

Chasen and Kloss (1931a) examined six rats from Lalang Island and concluded that they could be referred neither to *jarak* nor to *rumpia*. They suggested that the Lalang rat represented either a large *jarak* or a small *rumpia*, a definition aptly describing these specimens, which on size can be referred to neither race. Dorsally, the males are paler than *jarak*, having a greater admixture of buff tipped and ochraceous tipped hairs on the back and especially on the flanks. In both male specimens, the dorsal black tends to gather into the median line. The female, however, is darker above and resembles *jarak*. Ventrally, the males are yellowish (a condition exhibited by occasional male specimens of *rumpia* and by one male of the series of *jarak*) while the female is dirty white as is *jarak*. Measurements of an adult male and female (in parentheses): head and body 178 (180), tail 190 (188), occipitonasal length 41.8 (41.4), condylobasal length 40.4 (39.5) and maxillary toothrow 7.2 (6.9). It may be that *Rattus rattus* of Lalang Island requires subspecific definition but I am reluctant to take this step with the meagre material available.

**Rattus rattus payanus** Chasen and Kloss

Pulau Paya, Straits of Malacca: ♀ 55.3003.

Gibson-Hill (1949) lists the type specimen as 'believed lost'. This female specimen is darker dorsally than *rumpia* and has the long guard hairs on the lower back more developed than in this race. The dorsal black is gathered into the midline, especially on the lower back (a tendency shown by some examples of *rumpia*). Ventrally, *payanus* is creamy white as is *rumpia*. It is about the same size as the latter race. Measurements: head and body 199, tail 186, hindfoot 34, ear 19, occipitonasal length 45.6, condylobasal

length 43.0, condylobasilar length 40.1, palatal length 22.0, diastema 13.1, zygomatic width 20.6, maxillary toothrow 7.0, length of palatal foramina 8.1 and length of nasals 16.5.

**Rattus rattus pharus, subsp. nov.**

*Type Locality:* Pulau Pisang, Straits of Malacca.

*Type:* ♂ 55.3014. Skin and skull in good condition. Collected 27th April, 1916 by C. B. Kloss. Collector's No. K.6. F.M.S. No. 606/16.

*Other material:* ♂ ♂ 55.3015-3016, ♂ 55.3019 (skin only), ♀ ♀ 55.3017-3018. Pulau Pisang.

A rat combining the large size of *kunduris* with the brighter, more reddish colour of *jalorensis* of the mainland. *Rattus rattus pharus* is externally about the same size as *kunduris* but its skull averages slightly shorter and has a shorter toothrow. Dorsally, it is brighter in colour and is less blackened than *kunduris*. The underparts are creamy and are more yellowish than those of *jalorensis* or *kunduris*. The dorsal pelage is longer than that of *jalorensis* and is hispid with markedly developed long black or dark brown hairs on the lower back, which, however, are less appreciably developed than those of *kunduris*.

Dorsally, the type specimen is grizzled black and ochraceous orange, the black intensifying in the median line, especially on the lower back, and extending to the nape and the crown of the head. The cheeks are brownish and there is an ill-defined, slightly darker brown eye ring. The outer surfaces of the limbs and the flanks are pale brown and are sharply demarcated from the creamy ventral surface.

Measurements of the type specimen: head and body 183, tail 194, hindfoot 34.5, ear 21.5, occipitonasal length 42.2, condylobasal length 40.1, palatal length 23.4, zygomatic width 20.1, maxillary toothrow 6.9, length of palatal foramina 7.1, length of nasals 15.3 and greatest width of nasals 5.4.

Measurements of six skins and five skulls of *Rattus rattus pharus*: head and body 170-184 (178), tail 185-204 (193), occipitonasal length 40.8-43.4 (41.9), condylobasal length 38.6-40.7 (39.9) and maxillary toothrow 6.7-7.0 (6.9).

Chasen and Kloss (1931a) regarded *Rattus rattus* from Pisang as *jalorensis* × *kunduris*; these specimens, however, differ consistently from both races. They have been named in allusion to the lighthouse established on Pulau Pisang.

**Rattus rattus jemuris Chasen and Kloss**

Pulau Jemur, Aroe Islands, Straits of Malacca: ♂ ♂ 55.3181-3182, ♀ ♀ 55.3183-3186.

Gibson-Hill (1949) lists the type specimen of this race as 'believed lost.' The collection of the British Museum (Natural History) contains three specimens (♂ ♂ 8.2.25.18-20) collected at the same time as the specimen which Chasen and Kloss selected as the type, and also three specimens (♂ ♂ 8.1.25.34-36) collected in August 1906, three months earlier.

Those collected in November 1906 (part of the original series) exactly agree with the brief description. The underparts are buff brown with a slight admixture of black hairs, the limbs on their outer surfaces are greyish while the top of the head is of the same colour as the back or is only slightly darker. Dorsally, they resemble the mainland *jalorensis* but are more buffy and less blackened. The cheeks and flanks have a greyish cast, while the underparts are cream, with in one specimen (8.2.25.19) a strong greyish tinge. Those collected in August 1906, are much darker on the back and lack much of

the light brown or buff found in those just described, these being replaced by dark brown or black. The underparts of these specimens are cream white, strongly tinged with grey. Five specimens, collected February 1915, from the Robinson collection, are referred to this race. Dorsally, they are darker than those first described, but are not quite so dark as those collected in August 1906, and still retain to some extent the buff brown tints of the November series. Ventrally, they are cream white with little grey. Measurements of nine specimens: head and body 163–185 (172), tail 152–204 (177), condylobasal length 38.7–43.2 (40.5) and maxillary toothrow 6.7–7.3 (7.0).

**Rattus rattus tinggius (Miller)**

Pulau Tinggi, Johore Archipelago: ♂ ♂ 55.3020–3024, 55.3028, ♀ ♀ 55.3025–3027.

*Rattus rattus tinggius* is predominantly brown dorsally and lacks most of the black and ochraceous tints found in the darker mainland race *jaforenensis*. Its dorsal pelage is longer and denser than that of *jaforenensis* and although not markedly hispid it is more spinous than in the mainland race and there are no long black guard hairs on the lower back such as are found in the races from the islands of the Malacca Straits. The flanks are buff and the outer surfaces of the limbs fawn in colour. In this small series the ventral pelage of males exhibits a strong infusion of yellow while that of the females is dull white. A median stripe of grey extends down the chest of both males and females. Some skins show the effects of bleaching through exposure to bad weather conditions. One such, 55.3021, has the dorsal hair tips a pale straw colour, except on the head, where they are brown. Measurements of six skins and seven skulls (except where stated): head and body 185–199 (190), tail 192–227 (210), occipitonasal length 43.1–47.4 (44.8), condylobasal length 41.5–42.8 (42.2) (six skulls) and maxillary toothrow 7.2–8.0 (7.5).

**Rattus rattus roa (Miller)**

Pulau Aor, Johore Archipelago: ♀ 55.3031.

Pulau Dayang Bunting, near Pulau Aor: ♂ ♂ 55.3029–3030, 50.3032 (skin only), ♀ 55.3033.

*Rattus rattus roa* is closely similar to *R. r. tinggius* and on colour this small series can hardly be separated from the Tinggi race. The effect of weathering and exposure on the dorsal pelage of these rats, however, conceals to a large extent its true colour. 55.3030 is reddish brown dorsally, with little black, and exactly matches 55.3022 from Tinggi. Two other adult specimens, 55.3029 and 55.3031, have more black on the back and are more drab in appearance than skins from Tinggi. The dorsal pelage is long and dense, especially on the lower back. Males are more creamy and less yellowish ventrally than those from Tinggi while the female specimen has dull white underparts. An ill-defined median grey stripe extends down the chest. The measurements of three adults suggest that *roa* may be a slightly smaller rat than *tinggius*: head and body 167–195 (180), tail 221–226 (223), occipitonasal length 41.9–42.5 (42.3), condylobasal length 40.3–41.1 (40.6) and maxillary toothrow 7.1–7.3 (7.1).

**Rattus rattus sribuatensis subsp. nov.**

*Type Locality:* Pulau Sribuat, Pahang Archipelago.

*Type:* ♀ 55.3038. Skin and skull in good condition. Collected 12th June, 1912 by H. C. Robinson and E. Seimund. Collector's No. 4825. F.M.S. No. 403/12.

*Other material:* ♂ 55.3034, ♀ ♀ 55.3035–3037. Pulau Sribuat.

A rat having characters intermediate between those of *jalorensis* of the adjacent mainland and those of *tinggius* and *roa* from the outer islands of the Johore Archipelago. It may be distinguished from *jalorensis* by its brighter, richer dorsal colour and larger average size and from *tinggius* and *roa* by its redder, less brownish dorsal pelage, which is shorter than in these races.

Dorsally, the type is a rich, rufous brown with a small admixture of black, especially in the midline. The crown of the head is the same colour as the back and the cheeks and flanks are fawn. The dorsal pelage is less spinous than in *tinggius* and *roa* and the long black guard hairs on the lower back are less conspicuously developed. The outer surfaces of the thighs are fawn, with a greyish cast, and not buff brown as in *tinggius* and *roa*. The ventral surface is creamy white, sharply demarcated from the upper surface.

Measurements of the type specimen: head and body 191, tail 200, hindfoot 33.5, ear 21.7, occipitonasal length 44.3, condylobasal length 42.2, palatal length 24.3, zygomatic width 19.5, maxillary toothrow 6.9, length of palatal foramina 7.2, length of nasals 16.2 and greatest width of nasals 5.0.

Measurements of five skins and skulls (except where stated): head and body 182–195 (185), tail 191–207 (199) (four skins), occipitonasal length 42.4–44.3 (43.4) (four skulls), condylobasal length 39.5–42.4 (41.3) and maxillary toothrow 6.8–7.0 (6.9).

#### *Rattus rattus tiomanicus* (Miller)

Pulau Tioman, Pahang Archipelago: ♂♂ 55.3045, 55.3047–3048, ♀♀ 55.3046, 55.3049.

*Rattus rattus tiomanicus* differs from *jalorensis* in its darker back and greater average size. It is comparatively less blackened on the upperparts than *pemanggis* and has the outer surface of the thighs greyish and not buffy or brown as in that race. The underparts are white, heavily suffused with grey. It is smaller than *pemanggis* and has a shorter tail.

Measurements of five specimens: head and body 150–184 (169), tail 173–197 (188), occipitonasal length 39.1–42.8 (41.3), condylobasal length 36.9–40.3 (38.8) and maxillary toothrow 6.8–7.2 (7.1).

#### *Rattus rattus pemanggis* Chasen

Pulau Pemanggil, Johore Archipelago: ♂♂ 55.3039–3042, ♀♀ 55.3043–3044.

These specimens agree closely with the diagnosis by Chasen. They are darker above than *tiomanicus*, with the underparts cream or cream white, slightly tinged with grey and not heavily suffused with grey as in *tiomanicus*. *Rattus rattus pemanggis* averages a little larger and has a longer tail than this race. Measurements of six skins and four skulls: head and body 172–186 (178), tail 185–211 (202), occipitonasal length 39.7–44.5 (42.4), condylobasal length 37.1–42.0 (39.8) and maxillary toothrow 7.1–7.4 (7.2).

#### *Rattus rattus kabanicus* subsp. nov.

Type Locality: Pulau Kaban, Johore Archipelago.

Type: ♂ 55.3050. Skin and skull in good condition. Collected 17th June, 1915 by H. C. Robinson. Collector's No. 6958. F.M.S. No. 814/15.

Other material: ♂ 55.3051, ♀ 55.3052–3053 Pulau Kaban. ♂ 55.3054, ♀ 55.3055 Pulau Babi, Johore Archipelago.

This race is most closely allied to *R. r. tiomanicus* and *R. r. pemanggis*. It may be distinguished from the former by its underparts, which are white or creamy with little or no grey, and from the latter by its paler, more ochraceous back and flanks. The race

differs from *R. r. jalorensis* of the mainland in slightly greater size and darker dorsal pelage. The brighter ochraceous dorsal tints of *jalorensis*, which have almost completely disappeared in *pemanggis* and *tiomanicus*, are retained to a considerable extent in *kahanicus*. This race is nearer to *tiomanicus* than to *pemanggis* in its greyish and not brownish thighs and moderately dark back (in some cases with the blackening tending to gather in the median line). The dorsal pelage is plentifully supplied with softish spines.

Dorsally, the pelage of the type is uniformly grizzled dark brown and ochraceous, the dark colour tending to the formation of an ill-defined median dorsal stripe. The outer surfaces of the thighs are fawn grey, the forearms brown. The flanks are paler brown than the back and are less liberally tinted with ochraceous. The underparts are cream with no trace of a grey suffusion.

Measurements of the type specimen: head and body 176, tail 187, hindfoot 33, ear 21, occipitonasal length 42.7, condylobasal length 40.3, palatal length 23.7, zygomatic width 19.4, maxillary toothrow 6.7, length of palatal foramina 7.9, length of nasals 15.7 and greatest width of nasals 4.7.

Measurements of five skins and skulls: head and body 180–194 (185), tail 183–201 (190), occipitonasal length 43.0–44.2 (43.5), condylobasal length 40.5–41.8 (41.2) and maxillary toothrow 6.5–7.2 (6.9).

For the present, in the absence of a larger series, I prefer to leave unallocated three specimens (9.4.1.318–320) from the small island of Sibu, lying between Pulau Tinggi and the Johore coast. Chasen (1940) considered *Rattus rattus* from the islands of Sribuat, Kaban, Babi and Sibu to be *Rattus rattus jalorensis*  $\times$  *tinggius*. Those from Kaban he thought nearer to *jalorensis* and those from Sibu to *tinggius*. This view, however, seems over-simplified. Two lines of variation from the mainland *jalorensis* type can be discerned among the *Rattus rattus* of the small islands of the Johore Archipelago. One is towards paler backed rats which tend towards a drab, brownish dorsal colour with little or no black. This trend is exemplified by the series of races *jalorensis*—*sribuatensis*—*ron*—*tinggius*, each race successively showing a diminution of dorsal ochraceous and black in favour of buff and brown. The other is towards rats with darker backs and is exemplified by the series *jalorensis*—*kahanicus*—*tiomanicus*—*pemanggis*, which increase the amount of dorsal black at the expense of ochraceous. Specimens from Sibu are brighter on the back (and therefore nearer to *jalorensis*) than *pemanggis*, *tiomanicus* or *kahanicus* although like the two latter races they have greyish thighs. They are duller and darker above than those from Sribuat and have the underparts white, slightly tinged with grey. They are somewhat larger than *jalorensis* and for the present are best regarded as *Rattus rattus jalorensis*  $\times$  *kahanicus*. As might be expected from the location of Pulau Sibu, which is the nearest inshore of this complex of islands, they are very near to *jalorensis*. They are quite unlike *tinggius*, and lie on the line of variation tending towards rats with backs darker than that of *jalorensis*. Measurements of three specimens: head and body 173–183 (177), tail 202–208 (205), occipitonasal length 41.5–42.5 (42.0), condylobasal length 39.5–40.6 (40.0) and maxillary toothrow 6.8–7.1 (7.0).

#### *Rattus rattus viciana* (Miller)

Pulau Langkawi, off Perlis: ♂ 55.3060 Buraw. ♂ ♂ 55.3056–3058. ♀ 55.3059.

Pulau Dayang Bunting, near Pulau Langkawi, ♂ 55.3061, ♀ 55.3062.

A series of skins from Pulau Langkawi are duller and darker above than *jalorensis* but retain to a large extent the ochraceous tints found in this race. The underparts are

cream suffused with drab grey as in *pennatus* and *pannellus* from the Butang Islands, but the degree of grey suffusion is variable and in a few specimens the underside is creamy with very little grey. Two specimens from Pulau Dayang Bunting agree exactly with those from Langkawi.

Measurements of sixteen skins and fifteen skulls; head and body 152–177 (166), tail 165–201 (182), occipitonasal length 38.4–43.2 (40.4), condylobasal length 36.3–39.9 (38.1) and maxillary toothrow 7.0–7.6 (7.2).

**Rattus rattus jalorensis × viclana**

Pulau Telibon, off west coast Peninsular Siam: ♂♂ 55.3063–3065, ♀♀ 55.3066–3067.

These rats are closely similar to *jalorensis* in their dorsal colour, which is brighter and less drab than that of *viclana* from Langkawi. The ventral surface is cream as in *jalorensis*, and is unsullied by grey. They are about the same size as *viclana* and have the same robust skull but the toothrow averages shorter and is nearer in length to that of *jalorensis*. Chasen (1937) referred a series of *Rattus rattus* from Telibon to *viclana*, of which he had one topotype, but these specimens are separable from *viclana* by their shorter toothrow (although in one specimen this is as long as in *viclana*), cream belly and brighter upperparts. For the present they are best regarded as a link between the mainland race *jalorensis* and the race from Langkawi Island.

Measurements of five specimens: head and body 167–184 (174), tail 184–204 (193), occipitonasal length 40.0–42.6 (41.5), condylobasal length 37.3–40.9 (38.1) and maxillary toothrow 6.7–7.4 (6.9).

**Rattus rattus terutavensis subsp. nov.**

*Type Locality:* Telok Udang, Pulau Terutau, off west coast Peninsular Siam.

*Type:* ♀ 55.3070. Skin and skull in good condition. Collected 4th December, 1907 by a collector of the Federated Malay States Museum. Collector's No. 541. F.M.S. No. 2979/07.

*Other material:* ♂♂ 55.3068, 8.2.25.21, 9.11.1.122, ♀♀ 55.3071–3072, 8.2.25.25, 9.11.1.127–128 Telok Udang, Pulau Terutau. ♂♂ 55.3069, 9.11.1.123–125, ♀♀ 9.11.1.129–130 Sungai Udang, Pulau Terutau. ♂♂ 55.3073–3074 Telok Wau, Pulau Terutau. ♂ 9.11.1.121, ♀ 9.11.1.126 Pulau Terutau.

Chasen (1940) referred *Rattus rattus* from Terutau to *viclana*. A series from Terutau, however, may be separated from *viclana* of Langkawi by its darker dorsal surface, cream underside which has no trace of the grey suffusion characteristic of *viclana*, *pennatus* and *pannellus* and by its shorter toothrow. The series may be distinguished from *jalorensis* of the adjacent mainland by its much darker back, which lacks most of the bright ochraceous tints of that race, its greater external size and longer skull. These characters also distinguish it from the material listed above as *Rattus rattus jalorensis* × *viclana*. *Rattus rattus terutavensis* is dorsally a duller, darker, more brownish rat than *viclana*, with more dorsal black, especially in the mid-line, and with the darker colour of the back extending over the head, which is blackish and not brownish as in the Langkawi race. Four specimens have an indistinct grey median stripe on the chest.

Dorsally, the type is grizzled black and brown, the darker colour tending to concentrate in the mid-dorsal line, and extending over the head on to the muzzle. The dorsal

pelage is interspersed with soft white spines, and is longer on the rump than on the middle-back and foreback. Few of the dilute ochraceous tints of *vicinaria* are retained in *terutavensis*, and are mostly replaced by brown. Flanks, sides of throat and cheeks are paler than the back with little black. The underside is pure cream and closely similar to that of *jalorensis*.

Measurements of the type specimen: head and body 165, tail 186, hindfoot 34, ear 21, occipitonasal length 40.7, condylobasal length 39.2, palatal length 23.2, zygomatic width 19.6, maxillary toothrow 6.6, length of palatal foramina 7.4, length of nasals 15.0 and greatest width of nasals 4.6.

Measurements of eighteen skins and sixteen skulls: head and body 140–180 (164), tail 152–195 (178), occipitonasal length 37.5–40.5 (38.1) and maxillary toothrow 6.5–7.1 (6.8).

#### *Rattus rattus moheius* Chasen

Pulau Mohea, south island, off west coast Peninsular Siam: ♂ ♂ 55.3075–3076, ♀ ♀ 55.3077–3079.

Pulau Mohea, north island, off west coast Peninsular Siam: ♂ ♂ 55.3080–3083, ♀ ♀ 55.3084.

These specimens were collected at the same time as the series described by Chasen and agree exactly with the type and with his description. All have the mid-dorsal area and crown much blackened and sharply demarcated from the yellowish brown flanks. As in the original series, the whitish underparts are much stained with yellow. There is no appreciable difference between specimens from the two islands. Measurements of ten skins and nine skulls: head and body 178–196 (187), tail 185–231 (212), occipitonasal length 39.6–43.5 (42.1), condylobasal length 38.0–41.8 (40.2) and maxillary toothrow 7.5–8.1 (7.8).

#### *Rattus rattus pipidonis* Chasen

Koh Pipidon, off west coast Peninsular Siam: ♂ ♂ 55.3085–3086.

These specimens were collected at the same time as the series described by Chasen. Although not so conspicuously blackened in the mid-dorsal line as is *moheius*, they have the mid-dorsal darkening more pronounced than has the type, and, when compared with the type, are darker and more drab dorsally. The type, dorsally, is brownish, with a diffuse darker brown median streak extending from the crown to the hindquarters, while the flanks, forearms and thighs are a brighter, paler, more orange brown colour, sharply demarcated from the cream underside, which is stained with yellow. The two additional specimens have the dorsal streak with a greater admixture of black and have the flanks a drab, brown colour with few ochraceous or orange tints, and in appearance are nearer to *moheius*. The underparts are cream: a faint median grey stripe on the chest of the type is absent in 55.3085 and is more diffuse in 55.3086. Measurements (55.3086 in parentheses): head and body 220 (196), tail 195 (208), occipitonasal length 47.3 (45.5), condylobasal length 43.7 (42.1), and maxillary toothrow 7.8 (7.3). 55.3085 is an old male and apart from the tail is larger than any of those measured by Chasen in the original description. Koh Pipidon is about ten miles from the coast of Ghirbi, and the rats from this island are very similar to those listed above as *Rattus rattus jalorensis* × *tikoy* but are darker dorsally, have more developed dorsal spines and average larger with a larger skull. In colour they link the *Rattus rattus* rats of Pulau Mohea with those of the adjacent mainland.

**Rattus rattus lontarisi Chasen**

Pulau Lontar, off west coast Peninsular Siam: ♂ 55.3087, ♀ ? 55.3088-3090  
Pasir Raja, 55.3091 (skull only).

Collected at the same time as the series described by Chasen and in close agreement with the type specimen. *Rattus rattus lontarisi* differs markedly from *R. r. jalorensis* × *tikos* of the adjacent mainland and from the nearby island races in its soft dorsal pelage, which almost completely lacks spines. In colour, dorsally it closely resembles *jalorensis* × *tikos* from Ghirbi but averages brighter with less dorsal blackening. Ventrally, these specimens are cream.

Measurements of four skins and five skulls: head and body 159-163 (161), tail 188-201 (194), occipitonasal length 39.1-41.7 (40.3), condylobasal length 37.1-39.4 (38.1) and maxillary toothrow 6.4-6.7 (6.6).

**Rattus rattus alangensis × panjus**

Koh Mapru, off west coast Peninsular Siam: ♂ ♂ 55.3092-3093, ♀ ♀ 55.3094-3095.

Chasen (1937) (who had a much larger series) was unable to allocate it to either *panjus* or *alangensis*, but pointed out that the specimens were nearest in colour to *panjus* and in cranial size to *alangensis*. These specimens do not agree accurately in colour with the type of *panjus* but dorsally are duller and much less ochraceous orange and are generally greyer on the back and flanks. No dorsal darkening is evident. Ventrally, they are white with no yellow staining as is found in the types of *panjus* and *alangensis*. In colour they approximate much more closely to *jalorensis* × *tikos* from the adjacent mainland and the nearby island of Junk Seylon. 55.3092 is an old male with a very large skull. Measurements of three specimens: head and body 155-177 (169), tail 190-210 (200), occipitonasal length 41.6-43.8 (42.4), condylobasal length 38.8-42.3 (40.4) and maxillary toothrow 7.1-7.9 (7.5).

**(?) Rattus rattus dentatus (Miller)**

De Lisle Island (Koh Piam), off west coast Peninsular Siam: ♂ 55.3096.

Chasen (1937) referred specimens from De Lisle Island to *dentatus* without direct comparison of specimens. This specimen is brighter, more ochraceous and has less dorsal black than *tikos* of the adjacent mainland and has longer, harsher and more spinous dorsal pelage. It could not be referred to *dentatus* without hesitation. Dorsally, it is much brighter and more ochraceous orange than two specimens of *dentatus* from Hastings Island. Its dorsal pelage is longer and denser, and the flanks are yellow orange and not buffy as in *dentatus*. Ventrally, it is less tinged with ochraceous and the grey gorget does not extend on to the belly in a median line as in *dentatus*. The collection of the British Museum (Natural History) contains specimens from Hayes Island, King Island, Tavoy Island, Malcolm Island, Saddle Island and Sullivan's Island in the Mergui Archipelago but no topotypes of *insulanus* from Hefter Island, exuvia from James Island and *fortunatus* from Chancé Island. Our material is all near to *tikos* in appearance (and was in fact referred to this race by Ellerman and Morrison-Scott (1951)) but specimens from Tavoy Island, Sullivan's Island and Saddle Island are dorsally a little brighter than *tikos*, and, taken as a whole, our series from the Mergui Archipelago runs rather larger than *tikos* (occipitonasal length in fifteen specimens from the Mergui Islands 40.8-45.9

(43.5) and in ten specimens of *tikos* from Tenasserim 39.5–43.8 (41.3)). The single specimen from De Lisle Island agrees closely in colour with one from nearby Saddle Island. Measurements of a male from De Lisle Island: head and body 195, tail 195, occipitonasal length 42.6, condylobasal length 39.8 and maxillary toothrow 7.9.

**Rattus rattus fortunatus** (Miller)

Koh Yam Yai (Sugar Loaves), off west coast Peninsular Siam: ♂ ♂ 55.3097–3099.

Chasen (1937) tentatively referred rats from Koh Yam Yai to *fortunatus* and these specimens are referred to that race without direct comparison with topotypes. They agree with Miller's description in their brighter, yellowish dorsal colour and lack of dorsal darkening when compared with specimens from the other islands of the Archipelago.

Measurements of three specimens (except where stated): head and body 183–200 (192), tail 224–231 (226), occipitonasal length 45.6–45.9 (45.7), condylobasal length 43.3–44.3 (43.8) (two skulls) maxillary toothrow 7.5–8.0 (7.7).

**Rattus rattus kadanus** Chasen

Koh Kadan (Pulau Papan), off west coast Peninsular Siam: ♂ ♂ 55.3100–3102, ♀ ♀ 55.3103–3104.

Koh Muk (Pulau Muntia), off west coast Peninsular Siam: ♂ ♂ 55.3105–3107, ♀ ♀ 55.3108–3111.

These specimens were collected at the same time as the original series. Dorsally, they are very slightly darker than *jalorensis* × *tikos* from the adjacent mainland, especially in the mid-line. The ochraceous tints in the dorsal pelage of the mainland form are rather warmer in *R. r. kadanus*. The underparts are white or cream, occasionally stained with grey. Measurements of twelve skins and skulls (except where stated): head and body 173–192 (185), tail 208–241 (220) (eleven skins), occipitonasal length 42.5–44.8 (43.5), condylobasal length 40.2–43.1 (41.3) (eleven skulls) and maxillary toothrow 7.1–7.7 (7.3).

**Rattus rattus robinsoni** Chasen

Koh Pennan, off Bandon, Peninsular Siam: ♂ ♂ 55.3112–3118, ♀ ♀ 55.3119–3121.

Koh Samui, off Bandon, Peninsular Siam: ♂ ♂ 55.3122–3128, ♀ ♀ 55.3129–3131.

This material is part of that listed by Robinson and Kloss (1915). Specimens from Koh Samui are indistinguishable on colour from those listed as *jalorensis* × *tikos* from Bandon on the adjacent mainland but those from Koh Pennan are very slightly brighter above and have the dorsal pelage less blackish. The pale element in the dorsal pelage of these specimens is more yellow orange than in those from Koh Samui, some of which show a tendency to form a blackish median dorsal line. Measurements of twenty skins and skulls (except where stated): head and body 159–193 (176), tail 177–213 (194), occipitonasal length 39.5–44.4 (43.3) (nineteen skulls), condylobasal length 37.7–41.7 (39.6) (nineteen skulls) and maxillary toothrow 7.0–7.8 (7.5).

**Rattus rattus perhentianus** Chasen

East Perhentian Island, off Kelantan, Malay Peninsula: ♂ ♂ 55.3132–3137, ♀ ♀ 55.3138–3141.

Great Redang Island, off Trengganu, Malay Peninsula: ♂ ♂ 55.3142–3144.

The material from East Perhentian Island was collected at the same time as the series described by Chasen. Compared with *jalorensis* from the mainland it is larger and darker on the upperparts. All the specimens exhibit the large, open anterior palatal foramina described by Chasen, and all have convexly curved nasals. Otherwise, *Rattus rattus perhentianus* closely resembles *R. r. tinggius*. Three specimens from Great Redang Island are very slightly more blackened in the dorsal mid-line than those from East Perhentian. Measurements: head and body 170–197 (181) (thirteen skins), tail 183–225 (202) (thirteen skins), occipitonasal length 39.9–45.3 (42.8) (eleven skulls), condylobasal length 38.1–42.8 (40.3) (eleven skulls) and maxillary toothrow 6.9–7.6 (7.4) (twelve skulls).

**Rattus exulans concolor** (Blyth)

Perak: ♂ 55.3163, ♀ 55.3164 Maxwell's Hill, 2,500–4,000 ft.

Dindings: ♀ 55.3165 Tanjong Hantu.

Trengganu: ♀ 55.3166 Bukit Jong.

Penang Island: ♂ 55.3167 Telok Bahang.

Selangor: ♂ 55.3170 (skin only) Semangko Pass, Selangor-Pahang boundary, 2,500–4,500 ft. ♂ ♂ 55.3171–3172, ♀ 55.3173 Cheras, Ulu Langat. ♀ 55.3174 Klang Gates.

Johore: ♂ 55.3175, ♀ 55.3176 Padang Tuan, Segamat. ♂ 55.3177 Tanjong Gomok.

Pulau Aor, Johore Archipelago: ♂ 55.3178, ♀ ♀ 55.3179–3180.

This series, together with a large number of specimens in the collection of the British Museum (Natural History) from the Malay Peninsula, has been compared with material collected in Burma and Tenasserim by G.C. Shortridge. Most of the Peninsular specimens are warmer, browner and less grey dorsally than are those from Burma while their grey underparts (sometimes stained with ochraceous) are rather paler in a number of cases. Shortridge, however, collected most of his specimens in and around houses and settlements rather than from forest (Shortridge, in Wroughton (1915)). Pulau Tinggi, Johore Archipelago, should be added to the distribution as given in Chasen (1940).

**Rattus exulans ephippium** (Jentink)

East Java: ♂ 54.106 (skin only) Karangbolang. ♂ 54.167 Badjoelmati.

West Java: ♂ ♂ 54.161–165 Tjibodas.

Sarawak: ♂ 55.973, ♀ ♀ 55.974–975 Ulu Anyut, Paku, Sarebas. ♂ ♂ 55.976–978, ♀ ♀ 55.979–981 Anyut, Paku, Sarebas. ♂ ♂ 55.982–983, ♀ 55.984 Sungai Pelandok, Paku, Sarebas. ♂ 55.985, ♀ ♀ 55.986–987 Balingean. ♂ 55.988 Bukar, Samurakan. ♀ 55.989 Paku, Sarebas.

Chasen (1940) synonymises *Rattus schuitemakeri* Sody (*Ann. Mag. nat. Hist.* 1933, 12: 431, Pontianak, West Borneo) with *Rattus exulans ephippium*. However, Sody (1941) retains *schuitemakeri* for Bornean *exulans* on grounds of darker ventral surface when compared with Javan and Sumatran material. Excluding dark bellied specimens from Sarawak obviously trapped in and around houses, there is no taxonomically significant difference in belly colour between the series listed above. The small series from Java suggests that Javan specimens might average larger than those from Borneo and the Malay Peninsula but no definable difference in colour can be found between the respective series. Javan specimens average very slightly paler on the belly, but the difference is very small.

*Measurements of Rattus exulans concolor:*

*Burma and Tenasserim:* head and body 110–132 (118) (twenty-nine skins), tail 119–152 (140) (twenty-nine skins), condylobasal length 26.8–29.9 (28.4) (twenty-five skulls), maxillary toothrow 4.9–5.4 (5.1) (thirty-one skulls) and  $m^1-m^3$  (crowns) 5.1–6.3 (5.6) (thirty skulls).

*Malay States:* head and body 94–135 (117) (thirty-seven skins), tail 110–165 (132) (thirty-seven skins), condylobasal length 26.1–31.6 (28.3) (twenty-nine skulls), maxillary toothrow 4.8–5.5 (5.1) (thirty-five skulls) and  $m^1-m^3$  (crowns) 5.2–6.3 (5.7) (thirty-four skulls).

*Riau Archipelago:* head and body 94–127 (105) (nine skins), tail 122–142 (132) (eight skins), condylobasal length 26.5–30.3 (28.4) (seven skulls), maxillary toothrow 4.9–5.5 (5.2) (nine skulls) and  $m^1-m^3$  (crowns) 5.4–6.0 (5.8) (seven skulls).

*Measurements of Rattus exulans ephippium:*

*Borneo:* head and body 95–128 (115), tail 103–142 (127), condylobasal length 27.1–30.0 (28.5), maxillary toothrow 5.0–5.4 (5.3) and  $m^1-m^3$  (crowns) 5.5–6.2 (5.9) (eighteen specimens throughout).

*Java:* head and body 110–140 (125) (eleven skins), tail 125–158 (146) (nine skins), condylobasal length 26.5–30.7 (29.0) (seven skulls), maxillary toothrow 5.1–5.8 (5.5) (eight skulls) and  $m^1-m^3$  (crowns) 5.6–6.6 (6.0) (eight skulls).

These measurements confirm the observations of Chasen (1940) that the palate averages wider in *ephippium* than in *concolor* and that Javan material tends to average larger than that from Borneo. Rats with the narrowest palates, however, are found in Burma while the widest palates are found in Borneo and Java. An intermediate width is found among rats from the Malay Peninsula and the Rho Archipelago.

*Rattus exulans equile* Robinson and Kloss

*East Java:* ♂ 54.168 (the type specimen) (skin only), ♂ & 54.169–172, ♀ ♀ 54.173–177 Ongop Ongop, Idjen Massif, near Banjoewangie, 5,700 ft.

Gibson-Hill (1949) lists the type specimen as 'believed lost'. The skin, however, was among the Robinson collection but no trace has been found of the skull. The specimens listed above appear to be part of the original series. The race is closely similar to *ephippium* in colour but is greyer ventrally. It differs markedly from that race in its softer, denser, less spinous dorsal pelage and larger skull. Measurements of nine specimens (not including the type); head and body 107–130 (118), tail 105–153 (139), condylobasal length 27.7–31.6 (29.9), maxillary toothrow 5.5–6.2 (5.9) and  $m^1-m^3$  (crowns) 6.2–6.7 (6.4).

*Rattus annandalei annandalei* (Bonhote)

*Perak:* ♀ 55.3152 Taiping.

*Dindings:* ♂ ♂ 55.3153–3154 Tanjong Hantu. ♂ 55.3155 ♀ 55.3156 Tanjong Tuan (error for Tanjong Antu = Tanjong Hantu).

According to Chasen (1940), *R. r. annandalei* appears rare in the north of the Malay Peninsula. The only comparative material available in the collection of the British Museum (Natural History) is the immature type. 55.3153 and 55.3154 (both collected in August) have the dorsal pelage coarsely streaked with black and ochraceous, darker in the median line, as has the type. Of the other specimens (collected in April) 55.3156

is very similar, but 55.3155 is browner above and is less coarsely grizzled with black. White on the under parts in all four specimens is confined to the throat, the belly being cream and not white as in the type. Their naked ears and brown feet agree with those of the type. An immature specimen from Perak has the upperparts browner and less fulvous than those of the type, with cream underparts. ♂ 55.3133 has a reddish brown prescrotal patch and a rufous patch on the throat. External measurements of four adults from Dindings: head and body 180–203 (191), tail 215–250 (238). Cranial measurements are given in Table IV.

**Rattus annandalei bullatus** (Lyon)

Pulau Rupat, Straits of Malacca: ♀ 55.3157.

Singapore Island: ♀ 55.3158 Changi.

Johore: ♀ 55.3160 Tanjong Pinang, Sungai Lebam.

Selangor: ♀ 55.3159 Cheras.

*Rattus annandalei bullatus* is very similar to *R. a. annandalei*, of which, however, very little comparative material is available. A specimen from Pulau Rupat and a series from Singapore Island (*villosus* Kloss) have the back darker and more heavily admixed with black, especially in the median dorsal line, than do specimens from Johore and Selangor, which dorsally are however and nearer to *R. a. annandalei* from Dindings and Perak. Ventrally, all are creamy white, occasionally (55.3158, 55.3159) with an orange yellow tinge. External measurements of fourteen specimens (not including the type of *villosus*): head and body 178–225 (195), tail 207–257 (233). Cranial measurements are given in Table IV.

**Rattus mulleri validus** (Miller)

Peninsular Siam: ♂ 55.2910 Tasan, Chumpawn. ♀ 55.2911 Lam-ra, Trang. ♂ 55.2912 Kao Nong, Bandon. ♂ 55.2913 Tang Pran, Tahuatang.

Perak: ♀ 55.2914 Temengoh. ♂ 55.2915 Changkat Mentri. ♀ 55.2916 Maxwell's Hill. ♂ 55.2917 Telom, Perak-Pahang boundary.

Pahang: ♀ 55.2918 Tanjong Panjair, Rompin. ♂ 55.2919 Kota Tongkut, Kuantan Road.

Selangor: ♀ 55.2920 Ulu Langat. ♂ 55.2921 Menang Gasing, Ulu Langat.

External measurements of thirteen specimens: head and body 217–277 (242), tail 245–323 (288). Cranial measurements are given in Table IV.

**Rattus mulleri remotus** (Robinson and Kloss)

Koh Samui, off Bandon, Malay Peninsula: ♂ ♂ 55.3161–3162.

Two of the original series, Clasen (1940) allocates *remotus* as a race of *annandalei* but Ellerman (1949) and Ellerman and Morrison-Scott (1955) disagree and refer to it as a race of *mulleri*. Ellerman (1949), who had seen only the type, points out that it possesses the short bullae and long palatal foramina which he considers characteristic of *mulleri*. From the material examined, the palatal foramina of *remotus* are long as in *mulleri* and although its bullae run large for this species they are considerably less inflated and less globular than are those of *R. a. annandalei*. A summary of measurements to illustrate this point appears in Table IV. Externally, three specimens (including the type) of *remotus* differ from *validus* in their paler, browner dorsal colour (which may be due partially to the effects of bleaching) in which much of the black flecking of *validus* is missing. Their underparts, like those of *validus*, are cream. External measurements of 55.3162, a fully adult specimen: head and body 237, tail 288.

**Rattus mulleri borneanus (Miller)**

Sarawak: ♂ 55.936, ♀ 55.937 Sungai Pelanok, Paku, Sarebas. ♀ 55.938 Ulu Anyut, Paku, Sarebas. ♂ 55.939 Paku, Sarebas. ♂ ♂ 55.940, 55.942 (skin only), ♀ 55.941 Balingean. ♂ 55.943 Betong, Sarebas. ♀ 55.944 Sungai Lenin, Tinjar River, Baram. ♀ ♀ 55.945, 55.948 Long Lenin, Tinjar River, Baram. ♂ 55.946 Mora Barue, Samarahan. 55.947 (skull only). No precise locality.

Little colour variation is apparent in this series. *Rattus mulleri borneanus* closely resembles *R. m. validus* but is considerably smaller. External measurements of twelve specimens: head and body 178–223 (204), tail 218–264 (237). Cranial measurements are given in Table IV.

Table IV  
CRANIAL MEASUREMENTS OF *Rattus mulleri borealis* AND *Rattus mulleri*

	No. of specimens	Condyllobasal length	No. of specimens	Maxillary toothrow	No. of specimens	Length of bulb	No. of specimens	Length of palatal foramina
<i>R. m. annamitaei</i>	—	43.7–49.2 (46.5)	4	8.0—8.5 (8.3)	4	7.4—8.0 (7.8)	4	7.6—8.3 (7.9)
<i>R. m. ballonis</i>	—	40.5—48.1 (44.1)	14	7.9—9.0 (8.3)	14	7.6—8.6 (8.0)	14	6.6—8.2 (7.4)
<i>R. m. validus</i>	—	49.8—56.9 (53.6)	13	9.5—11.2 (10.3)	13	6.2—7.1 (6.7)	13	9.0—11.0 (9.9)
<i>R. m. formosus</i>	—	47.1—51.9 (49.3)	15	8.8—10.0 (9.5)	15	6.0—7.3 (6.7)	15	7.8—9.7 (8.7)
<i>R. m. borealis</i>	—	44.0—51.2 (47.4)	13	8.3—9.7 (9.1)	12	6.2—6.9 (6.5)	13	7.6—9.1 (8.3)
<i>R. m. remensis</i> Type	—	46.0	—	8.2	—	7.1	—	9.4
<i>R. m. remensis</i> 55.3162	—	47.6	—	8.9	—	8.0	—	9.0

**Rattus sabanus sabanus (Thomas)**

Sarawak: ♂ 55.893, ♀ ♀ 55.892 (skin only), 55.894–902 Mount Dulit, Baram, 3,000–3,500 ft. ♂ 55.903, ♀ 55.904 Gunong Sidong, Samarahan, 1,200 ft. ♀ 55.905 Bukar, Samarahan. ♂ 55.906 Paku, Sarebas. ♀ 55.891 (skull only). No precise locality.

Specimens from Mount Dulit (collected in July and August, 1919) agree closely in colour with the type specimen and with other material from Dulit and Kinabalu. Those from Samarahan and Sarebas (collected in November, 1919 and February, 1917 respectively) are less black in the mid-dorsal line and have fewer long dark dorsal guard hairs. Measurements of ten specimens: head and body 195–239 (218), tail 328–398 (348), condyllobasal length 47.3–54.0 (50.2) and maxillary toothrow 10.0–10.7 (10.3).

**Rattus sabanus vociferans (Miller)**

Peninsular Siam: ♂ 55.2842 Khao Luong, Nakhon Sri Thammarat, 2,000 ft. ♂ 55.2843 Kao Nong, Bandon, 1,200–1,500 ft. ♂ 55.2844, ♀ 55.2845 Nongkok, Gherbi, 55.2846 (skull only) Nongkok, Gherbi, ♀ 55.2847 Tasan, Chumpawn. ♂ 55.2848 Lam-ra, Trang.

Perak: ♂ 55.2849, ♀ 55.2850 Gunong Ijau, 4,000 ft. ♂ 55.2851 Ulu Selama. ♂ ♂ 55.2852–2853, ♀ ♀ 55.2854, 55.2855 (skin only) Maxwell's Hill, Larut.

Pahang: ♀ 55.2859 Genting, Kuala Lipis.

Selangor: ♀ 55.2856, ♂ ♂ 55.2857–2858 (skulls only) Ginting Bidai, 2,300 ft. ♂ 55.2860, ♀ 55.2861 Cheras, ♀ 55.2866 Klang Gates.

Negri Sembilan: ♂ 55.2862 Bukit Lantar, 2,500 ft. ♀ 55.2863 Bukit Tangga.

Johore: ♂ 55.2864 Si Karang, ♀ 55.2865 (skull only). No precise locality.

There is no great difference in colour between this rat and *R. s. sabanus* (*fide* Chasen and Kloss (1931)). Specimens from the Malay Peninsula average slightly paler and duller and are usually less black in the mid-dorsal line than those from Borneo. Measurements of fifty-three skins and fifty-one skulls: head and body 208–290 (239), tail 270–414 (358), condylobasal length 46.7–54.0 (51.9) and maxillary toothrow 9.5–10.9 (10.1).

**Rattus sabanus tersus** (Thomas and Wroughton)

Pulau Terutau, off west coast Peninsular Siam: ♂ ♂ 55.2878–2880, ♀ ♀ 55.2881–2883 Telok Wau. ♂ 55.2884 (skin only) Sungai Udang. ♂ 55.2885.

*Rattus sabanus tersus* averages brighter above than *R. s. vociferans* from the mainland and lacks much of the darker mid-dorsal area of that race. It is said by Thomas and Wroughton in the original description to be darker dorsally than *R. s. lancavensis* but these specimens, together with a good series already in the collection, average very slightly paler and brighter than that race, which has its dorsal surface very similar to that of *R. s. vociferans*. Reflectometer readings made with white light on the central part of the back illustrate the slight difference in intensity of darkening involved. Reflectance values obtained with eighteen specimens of *tersus* were 18–24 (19) per cent and with seventeen specimens of *lancavensis* 16–20 (18) per cent of the reflectance of the standard surface. Measurements of *R. s. tersus*: head and body 198–235 (217) (eighteen skins), tail 290–342 (322) (seventeen skins), condylobasal length 45.7–50.5 (48.5) (sixteen skulls) and maxillary toothrow 9.2–10.2 (9.8) (seventeen skulls).

**Rattus sabanus lancavensis** (Miller)

Pulau Langkawi, off Perlis: ♂ ♂ 55.2888–2890 Sungai Kilim. ♂ ♂ 55.2886–2887.

This rat may be separated on colour from the mainland *R. s. vociferans* only with difficulty, averaging very slightly more yellow on the flanks and thighs and slightly less dark on the back. It is, however, somewhat smaller than the mainland race. Measurements: head and body 210–250 (231) (seventeen skins), tail 310–375 (335) (sixteen skins), condylobasal length 47.3–52.2 (50.0) (sixteen skulls) and maxillary toothrow 9.7–10.3 (9.9) (seventeen skulls).

**Rattus sabanus salanga** Chasen

Junk Sylon, off west coast Peninsular Siam: ♂ ♂ 55.2867–2869, ♀ 55.2870 Klong Tun Sai.

Pulau Panjang, off west coast Peninsular Siam: ♂ ♂ 55.2871–2872, ♀ 55.2873 Telok Poh.

Pulau Telibon, off west coast Peninsular Siam: ♂ 55.2874.

Pulau Lontar, off west coast Peninsular Siam: ♂ ♂ 55.2875–2876, ♀ 55.2877 Pasir Raja.

As stated by Chasen in the original description, specimens from Junk Sylon are most differentiated from those from the adjacent mainland and those listed above are very slightly less dark dorsally and have less black dorsal ticking than *R. s. vociferans* from Nongkok, Ghirbi and Trung. Specimens from the other inshore islands, however, exactly resemble the mainland race in colour and can be separated from it only by their slightly smaller size. Measurements of ten specimens (except where stated): head and body 200–230 (217), tail 303–350 (320), condylobasal length 47.5–52.6 (49.6)

(nine specimens) and maxillary toothrow 9.7–10.5 (10.0). This race, not markedly differentiated from the mainland race, occupies an intermediate position between that race and *R. s. tenuis* from Pulau Terutau.

(?) *Rattus sabanus matthaeus* (Miller)

De Lisle Island (Koh Priam), off west coast Peninsular Siam: ♀ 55.2891.

Although Chasen (1940) referred *sabanus* rats from De Lisle Island to *R. s. lucas* (Miller) from St. Luke's Island, Mergui Archipelago, this specimen is provisionally allocated (without direct comparison of specimens) to *R. s. matthaeus* from the geographically nearer island of St. Matthew. Dorsally, it is darker and more richly coloured than *R. s. vociferans* from the nearby mainland. The back is tawny to rufous tawny and not ochraceous as in *vociferans*, and is liberally sprinkled with brownish-black hairs. The flanks are rufous orange in colour and are much less yellow than the flanks of *vociferans*. The underparts are yellow-cream. In these respects it agrees with the diagnosis of *R. s. matthaeus* more closely than with that of *lucas*, which is said by Miller to be a pale rat rather like *stridulus* and *lancavensis*, from which latter race this rat differs in its darker, more rufous colour. Measurements: head and body 245, tail 332, hindfoot 45, ear 29, greatest length of skull 55.4, condylobasal length 50.9, zygomatic breadth 25.4 and maxillary toothrow 10.7.

*Rattus sabanus stridens* (Miller)

Pulau Tioman, Pahang Archipelago: ♂ ♂ 55.2892–2894, ♀ ♀ 55.2895–2896 Juara Bay, ♂ 55.2897.

Measurements of six specimens: head and body 220–256 (233), tail 316–347 (330), condylobasal length 49.0–53.3 (51.5) and maxillary toothrow 9.9–10.3 (10.1).

*Rattus sabanus mayapahit* Robinson and Kloss

East Java: ♂ ♂ 54.178–179 Sodong Jerok, Ijen Massif, near Banjocwangie, 3,900 ft.

♂ 54.178 is the adult male the measurements of which are given by Robinson and Kloss in the original description while 54.179 is the immature male mentioned by these authors.

*Rattus rajah rajah* (Thomas)

Sarawak: ♂ ♂ 55.907–908, ♀ 55.909 (skin only) Balingean. ♂ ♂ 55.910–913, ♀ ♀ 55.917–918 Betong. Sarebas. ♂ 55.914 Ulu Paku, Sarebas. ♂ 55.919 Gunong Sidong, Samarahan. ♀ 55.915 Sungai Lenin. Tinjar River, Baram. ♀ 55.916 (skin only). No precise data.

Published opinions on the respective status of *Rattus rajah* and *Rattus surifer* vary. Chasen (1940) retained both as full species with races occurring together in Borneo, the Malay Peninsula and possibly in Java. Sody (1941) followed this arrangement but points out that the characters used by Robinson (1921) in separating the Bornean *Rattus surifer bandahara* and *Rattus rajah rajah* (reiterated with additional characters by Kloss (1921a)) do not pertain to material from Java. Ellerman (1949) (who had very little Bornean material) agreed with Chasen that two distinct forms (*Rattus rajah pellax* and *Rattus surifer surifer*) occurred together in the Malay Peninsula and possibly also (*Rattus rajah rajah* and *Rattus surifer bandahara*) in Borneo. He transferred to *rajah* a number of races listed by Chasen as races of *surifer* on the grounds that they possessed small bullae, a character he thought to be diagnostic of *rajah*. Later, Ellerman and Morrison-Scott

(1951) revised this opinion, and listed all forms of the *rajah*—*surifer* group occurring to the north of Chasen's area as races of *rajah*, while suggesting that *pellax* might be the second Malaysian species. They also suggest that *pellax* might prove synonymous with *surifer*, thus leaving only one species in the Malay Peninsula. Ellerman and Morrison-Scott (1955) seem to have adopted this latter view and suggest that *Rattus rajah* and *Rattus surifer* are probably conspecific. Finally, Harrison (1957) is inclined to take the same view (at least for Malaya alone) but also lists objections to it and to the opinion that in Malaya *surifer* is only a colour variant of *pellax*. Little material has hitherto been available to workers in London and although the Robinson collection contains good series of many of the named forms of the *rajah*—*surifer* group, the collection of the British Museum (Natural History) is deficient in specimens from Borneo, Java and Sumatra. In general, adults of the *rajah*—*surifer* group from Borneo can be divided readily into two groups corresponding to *R. r. rajah* and *R. s. bandahara* and the large amount of material now available from the Malay Peninsula is equally easily divisible into two groups corresponding to *R. r. pellax* and *R. s. surifer*. Apart from two of the small islands of the Rhin Archipelago, no rats of the *rajah* type have been found among a very large series of *Rattus surifer* from most of the small islands lying off the coasts of the Malay Peninsula, a fact lending little support to the hypothesis that *surifer* is a colour phase of *pellax* (*vice versa*). The classification of this difficult group offered by Chasen has the merit of practical convenience and in general, it has been followed in the present paper.

Thirteen specimens from Sarawak are referred to *Rattus rajah rajah*. They agree favourably with the type specimen, which is in very poor condition and which has the tail missing. Dorsally, they are brown, and lack rufous or orange tinge, but occasionally have an indistinct, broad darker brown or blackish mid-dorsal streak. The crown and nape are the same colour as the back while the cheeks, flanks and the outer surfaces of the limbs are a slightly paler brown clearly demarcated from the cream white underparts. The dorsal and flank pelage is coarse, harsh and heavily intermixed with grey spines. The tail is brown above for most of its length and is cream white ventrally and at its tip. There is often a brownish patch, which in some specimens is reduced to a few brownish hairs, in the centre of the belly. There is no trace of an orange gorget. The ventral pelage in fully adult specimens is harsh and semi-spinous. In all of the specimens examined the white of the underparts extends in a narrow line down the inner surface of the thigh to the feet and is not cut off by the brown colour of the outer surface. The dorsal and flank pelage in adult specimens is brown based but in subadult specimens the hair bases are greyish.

Juvenile and subadult specimens are difficult to separate from those of *Rattus surifer bandahara* but adults of *rajah* differ from this rat in their browner, duller dorsal pelage, lacking ochraceous or orange tints and which is harsher and more spinous than that of *R. s. bandahara*. In all the specimens examined the white of the underparts extends down the inner surface of the thighs to the feet and is not cut off by an encircling band of the brown colour of the outer surface. The skulls examined all have the nasals prolonged posteriorly beyond the fronto-maxillary suture but this character is not absolute and occurs not infrequently in *R. s. bandahara*. Measurements of six specimens (all fully adult with the teeth well worn): head and body 190–220 (208), tail 188–222 (207), occipitonasal length 45.7–50.0 (47.4), condylobasal length 42.4–45.8 (43.7), palatal length 23.2–24.7 (23.9), zygomatic width 19.7–21.2 (20.5), interorbital breadth 6.9–7.7 (7.3), length of bulla 4.6–5.0 (4.8), width of bulla 3.4–4.0 (3.9), maxillary tooth-row 6.6–8.1 (7.1), diastema 13.0–14.1 (13.5), length of palatal foramina 6.5–7.3 (7.0) and width of palatal foramina 3.5–4.4 (3.9).

*Rattus rajah pellax* (Miller)

Perak: ♂ ♂ 55.2760-2762, ♀ ♀ 55.2763-2768 Changkat Mentri, ♂ 55.2774, ♀ 55.2774A Ulu Selama, ♀ 55.2775 Krian Road. ♂ ♂ 55.2757A-2757D Runuk Tanjong. Dindings: ♂ ♂ 55.2755-2658, ♀ 55.2759 Pulau Pangkor Besar. Selangor: ♂ 55.2769, ♀ ♀ 55.2770-2771 Rawang. 55.2772, ♂ 55.2773 (skin only) Klang Gates.

Pahang: ♂ 55.2776 Bukit Bangkong, Rompin.  
Singapore Island: 55.2750.

*Rattus rajah pellax* is a brown backed rat, its dorsal colour varying from light brown to dull buff brown, often with an admixture of black. The dorsal pelage is harsh and profusely spinous. Like the typical race, most specimens are darker in the dorsal mid-line, but the majority of such specimens are less darkened than is *rajah*. Some specimens show little or no trace of mid-dorsal blackening. The crown is the same colour as the back and the face is brownish with a conspicuous dark brown eye-ring. In adults the dorsal pelage is brown based but young specimens have the brown hairs of the back with a greyish cast at the base. The numerous dorsal spines are grey. Ventrally, these specimens are cream white as is *rajah*, clearly demarcated from the brownish flanks. The white of the underparts extends on to the dorsal surface of the feet in a narrow line down the inside of the thigh. None of the series has any indication of a gorget but in a majority of the specimens there is a patch of ochraceous brown hairs in the centre of the belly; in a few specimens this is represented only by a few brown hairs. The tail is bicoloured for most of its length, brown above and dull white below and at the tip. The feet are dull white above. Of twenty-eight skins examined, one only shows the white crown spot mentioned by Miller in the original description but seven others have it represented by a few white or white tipped hairs on the crown of the head. *Rattus rajah pellax* appears separable from *R. r. rajah* only on average characters. It averages very slightly duller dorsally and is usually rather less blackened. The dark eye-ring is more conspicuous. A more representative series of *R. r. rajah* than that available might show the two forms to be synonymous.

Three young adult specimens from Pulau Karimun (♂ ♂ 9.4.1.354-355, ♀ 9.4.1.362) hitherto referred to *Rattus surifer lingensis*, prove on examination to represent *R. r. pellax* from that island. Their dorsal pelage is dull wood brown, heavily spinous and strongly admixed with black in the mid-dorsal line and on the rump. The flanks are paler brown than the back but have no ochraceous or rufous element. The head is brown with a conspicuous darker brown eye-ring. Ventrally, they are white, sharply demarcated from the flanks, and all have a mid-ventral median streak of ochreous brown hairs. The white of the underparts extends on to the feet as in *pellax*, which although recorded from Durian Island by Chasen (1940) is apparently unrecorded from any of the other islands of the Rhio Archipelago.

Adults of *R. r. pellax* may be distinguished from those of *Rattus surifer surifer* by their somewhat duller dorsal pelage, which is browner and less coarsely streaked with black than in *surifer* and which almost entirely lacks any reddish or ochraceous tinge. The eye-ring is less conspicuous, and the face is browner, lacking much of the black found in *surifer*. The white of the underparts in *pellax* is continued on to the dorsal surface of the hind feet while in *surifer* it is generally cut off from the feet by a band of ochreous hairs but this character is not absolute and rats having otherwise the appearance of *surifer* sometimes have a narrow strip of white extending along the thigh to the feet.

Harrison (1957) gives a useful key for separating these rats, which he treats as "forms" of *Rattus rajah*, pending genetical and other studies to establish their relationship. While there is much to commend this treatment, it takes no account of the forms of *Rattus rajah* and *Rattus surifer* from Borneo, Sumatra and Java, all of which apparently are closely allied either to *Rattus rajah* or to *Rattus surifer* as understood in the present paper, and which, at least in Borneo, are sympatric. Measurements (of adult specimens only one of which has the teeth heavily worn): head and body 162–220 (197) (seventeen skins), tail 173–215 (201) (fourteen skins), condylobasal length 38.0–46.1 (44.1) (eighteen skulls) and maxillary toothrow 6.8–7.4 (7.1) (eighteen skulls).

***Rattus surifer surifer* (Miller)**

Tenasserim: ♀ 55.2458 Bankachon, Victoria Province.  
 Peninsular Siam: ♂ ♂ 55.2437, 55.2439 (skull only), ♀ 55.2438 Chong, Trang, 250 ft. 55.2440 Song Hong, Trang. ♂ ♂ 55.2441–2442 Lam-ra, Trang. ♂ 55.2443. ♀ 55.2444 Gap, Patelung, Trang. ♂ ♂ 55.2445–2449. ♀ ♀ 55.2450–2451 Tasan, Chumpawn, 220 ft. ♂ ♂ 55.2452–2454. ♀ ♀ 55.2455–2457 Hat Sanuk, near Koh Lak, Raiburi. ♂ ♂ 55.2459–2463. ♀ ♀ 55.2464–2466 Tap-li (Klong Wan), Pakchan. ♂ ♂ 55.2467–2568 Marmok, Pakchan. ♂ ♂ 55.2469–2470. ♀ 55.2471 Khao Luong, Nakon Sri Tamarat, 2,000 ft. ♂ 55.2472 Ban Kok Klap, Bandon, 50 ft. ♂ ♂ 55.2473–2475. ♀ 55.2476 Hao Nong, Bandon, 1,200–3,500 ft. ♂ ♂ 55.2477–2480. ♀ ♀ 55.2481–2483 Nongkok, Ghirbi.

Kedah: ♂ 55.2484 Gurun, Kedah. ♂ 55.2485 Kedah Peak, 3,000 ft.

Perlis: ♂ ♂ 55.2492–2493 Pelarit. ♀ 55.2511 Padang Sirch, Perlis–Singgora border.

Perak: ♂ 55.2486, ♀ ♀ 55.2487–2488 Maxwell's Hill, 3,000–4,000 ft. ♀ 55.2489 Lenggong. ♂ 55.2490. ♀ 55.2941 Temengoh, 400 ft. ♂ 55.2494. ♀ ♀ 55.2495–2498 Gunong Ijau, near Taiping, 4,500–4,700 ft. ♂ 55.2507. ♀ 55.2508 Ulu Selama. ♂ ♂ 55.2509–2510 Bukit Gantang.

Penang Island: ♂ ♂ 55.2499–2501. ♀ ♀ 55.2502–2503 Telok Bahang.

Dindings: ♂ ♂ 55.2504–2505. ♀ 55.2506 Tanjong Hantu.

Pahang: ♂ 55.2514 Kota Tongkat, Kuantan Road. ♀ ♀ 55.2512–2513 Bentong.

Selangor: ♀ 55.2516 Ginting Bidai, 2,300 ft. ♂ ♂ 55.2517–2518. ♂ 55.2526 (skull only) Cheras. ♂ 55.2519 Rawang.

Negri Sembilan: ♀ 55.2520 Ayer Kring, Negri Sembilan–Pahang border. ♀ 55.2521 Bukit Tampin. ♂ 55.2522. ♀ 55.2523 Tanjong Tuan.

Johore: ♂ 55.2524 Si Karang. ♀ 55.2525 Padang Tuan, Segamat.

This extensive series of this rat, combined with that already contained in the collection of the British Museum (Natural History), provides a valuable sample of *Rattus surifer surifer* from most of its known range. *Rattus surifer surifer* is dorsally bright ochraceous brown, coarsely streaked with varying amounts of black. The dorsal pelage is profusely spinous. The crown is the same colour as the back and the cheeks are clear ochraceous orange usually with an admixture of black hairs. The flanks and the outer surfaces of the limbs are clear ochraceous orange. The dorsal and flank pelage is grey based. The underparts are white, the white rarely extending down the inner surfaces of the hind legs to the dorsal surface of the feet but usually separated from the feet by an encircling band of ochraceous. Feet dull white above. Tail bicoloured, dorsally brown, ventrally and usually for the terminal quarter, white.

There appears to be little clinal variation in colour over the range as represented by this series, although considerable individual variation is present, especially as regards the degree of dorsal blackening. In general, specimens from the most southerly localities are brighter than those from localities further north. Those from Hat Sanuk are duller and paler than those from more southerly localities while those from Nongkok and Ghirbi average very slightly more brightly ochraceous than specimens from the northern Malay States. Specimens from Tenasserim are paler than more southerly specimens, and their duller dorsal pelage approaches that of *pellax*. It is, however, grey based and yellowish tipped in the characteristic manner of *surifer*. Individual variation in the degree of dorsal blackening has apparently no seasonal basis. Medium mid-ventral patches of yellowish-brown hairs are frequently present and an orange gorget (or traces of one) is found in a number of specimens. One specimen from Bandon (55.2476) has the entire ventral surface ochreous-brown, the normal cream or white being reduced to a few patches.

*Rattus surifer surifer* may be distinguished from *Rattus rajah pellax* by its brighter, more ochraceous dorsal pelage, which is conspicuously streaked with black and not a uniform mixture of black and brown as in *pellax*. The flanks of *R. s. surifer* are more ochraceous orange and are brighter than the back, unlike *pellax*, in which the flanks are dull brown. The dorsal pelage in *surifer* is grey based while in *pellax* it is brown based although subadult specimens of *pellax* have the dorsal hairs with a greyish cast at the base. The eye ring in *surifer* is darker and more conspicuous and the face is blacker and less brown than in *pellax*. Measurements of specimens from various parts of the range:

*Malay States* (to 7° N.): head and body 164–220 (193) (forty-one skins), tail 171–299 (199) (thirty-nine skins), condylobasal length 39.0–45.3 (42.3) and maxillary toothrow 6.2–7.4 (6.9) (thirty-nine skulls in both cases).

*South Peninsular Siam* (7°–9° N.): head and body 165–214 (185), tail 167–217 (193) (twenty-three skins in both cases), condylobasal length 39.6–44.8 (41.3) and maxillary toothrow 6.3–7.3 (6.8) (seventeen skulls in both cases).

*Tenasserim, etc.* (north of 9° N.): head and body 162–207 (187) (thirty-two skins), tail 178–216 (197) (twenty-nine skins), condylobasal length 38.2–44.3 (40.5) (thirty-two skulls) and maxillary toothrow 6.0–7.3 (6.7) (thirty-three skulls). Although the variation is small, the series examined suggests that a decrease in average size occurs in a northerly direction over the range, specimens from Tenasserim being somewhat smaller than those from the Malay States.

#### *Rattus surifer bandahara* Robinson

North Borneo: ♂ 55.920 Saip, Mount Kinabalu.

Sarawak: ♂ 55.921 (skin only). ♀ 55.922–926 Mount Dutil, Barom, 3,200–3,400 ft. 55.927–928 (skulls only). No precise locality. ♂ 55.929–930 Sungai Lenin, Tinjar River, Barom, 500 ft. ♂ 55.931–932 Long Lenin, Tinjar River, Barom. ♂ 55.933–934, ♀ 55.935 Gunong Sidong, Samarahan, 1,200 ft.

These specimens represent the second species of the *rajah–surifer* complex in Borneo and agree closely with the type of *R. s. bandahara*. Their grey based dorsal pelage is strongly ochraceous or orange with a black grizzle usually intensifying in the median dorsal line and disappearing on the flanks, which are ochraceous orange and sharply demarcated from the white underparts. The top of the head and the nape are the same colour as the back, as is the outer surface of the thighs. The outer surfaces of the forelegs are generally paler and the same colour as the flanks. The tail is bicoloured for most of its

length and is blackish brown above and cream white beneath and at the tip. Ventrally, *R. s. bandahara* is white with an orange or orange yellow gorget (which in a few specimens is reduced to a few orange hairs) and in all the specimens examined the white of the underparts is quite cut off from the hindfeet by the richer colour of the thighs, which encircles the entire thigh. Juvenile specimens are greyer and duller in colour than are adults and resemble those of *Rattus rajah rajah*. The adults, however, are easily separated from those of *rajah* by their much brighter, more ochraceous dorsal pelage, which tends to be softer and denser and less profusely spinous, by having the white of the underside not extending on to the feet, by their grey based dorsal fur and often by the presence of an orange or orange yellow gorget, which does not occur in any of the specimens here referred to *R. r. rajah*. Robinson also uses as a character "nasals not prolonged backwards beyond the fronto-maxillary suture as in *R. rajah* and *R. pellax*". This character is not absolute and in four specimens of the present series the nasals clearly extend beyond that suture. Measurements (all of young adult specimens with the teeth barely worn or unworn): head and body 160–185 (169) (nine skins), tail 170–250 (204) (eight skins), condylobasal length 37.9–42.3 (40.1) and maxillary toothrow 6.5–7.4 (7.0) (eight skulls in both instances).

#### *Rattus surifer solaris* Sody

East Java: ♂ 54.239, ♀ 54.240–243, 54.244 (skin only) Sodong Jerok, Idjen Massif, near Banjoeuwangi, 3,900 ft.

This small series is referred to *R. s. solaris* without direct comparison of specimens. In appearance they are very similar to a small series (mostly of topotypes) of the Sumatran *R. s. rarus* but are slightly less blackened above and are a slightly paler yellow. This agrees with the findings of Chasen (1940) who examined the Raffles Museum series of these races. A well marked orange brown gorget is present in 54.239 and there are traces of the gorget in the other specimens. The cream white of the underparts is continued in a narrow band down the inner thigh to the feet in 54.239 and 54.243 while in the remainder of the specimens it is separated from the feet by an ochraceous brown band, a condition corresponding with that noted in *rarus* by Robinson and Kloss (1918b) (1919). No specimens of *Rattus rajah verbeekii* are available for comparison. Measurements of four specimens: head and body 147–170 (160), tail 171–188 (178), condylobasal length 37.5–39.2 (38.1) and maxillary toothrow 6.0–6.9 (6.5).

#### *Rattus surifer luteolus* (Miller)

De Lisle Island (Koh Piam), off west coast Peninsular Siam: ♂ ♂ 55.2527–2529, ♂ ♀ 55.2530–2531.

Koh Yam Yai (Sugar Loaves), off west coast Peninsular Siam: ♂ 55.2532, ♀ ♀ 55.2533–2536.

These specimens are referred to *luteolus* without direct comparison of specimens. They agree closely with Miller's description. Dorsally, material from Koh Yam Yai is darker and blacker than that from De Lisle Island, in which the dark dorsal area forms a broad, ill-defined stripe (c.f. *umbridorsum* Miller). Ventrally, there is no trace of a yellow or orange gorget. Those from Koh Yam Yai have the flanks slightly less ochraceous and more plentifully supplied with coarse spines than those from De Lisle Island. Specimens from both islands are darker on the back and head than *R. s. surifer* from the adjacent mainland, and have the dorsal pelage more coarsely flecked with black, while the flanks are less brightly ochraceous. A well marked dark brown eye-ring is present.

Measurements of five specimens from De Lisle Island: head and body 171–195 (183), tail 168–183 (176), condylobasal length 37.8–41.4 (39.3) and maxillary toothrow 6.9–7.4 (7.2). Of five specimens from Koh Yam Yai: head and body 168–199 (184), tail 154–182 (169), condylobasal length 36.7–42.0 (39.8) and maxillary toothrow 6.5–6.8 (6.7). Both islands have *surifer* rats smaller than those of the adjacent mainland. Those from Koh Yam Yai are about the same size as those from De Lisle Island but have a comparatively shorter toothrow.

**Rattus surifer casensis (Miller)**

Koh Rah, off Takopah, west coast Peninsular Siam: ♂ ♂ 55.2580–2586, ♀ 55.2587–2588.

Koh Pra Tung, off Takopah, west coast Peninsular Siam: ♀ 55.2589.

These specimens are similar to those listed above as *luteolus* in having the dorsal pelage darker and more coarsely flecked with black than *R. s. surifer* from the mainland but differ from them in having the back and flanks slightly brighter and more orange, nearer to the colour of the mainland form and not to the paler, more ochraceous shade of *luteolus*. As in *luteolus*, the dorsal and flank pelage is harsh and spinous, and there is a well defined dark brown eye-ring. The ventral surface is white or cream white. Specimens from Koh Rah have an orange gorget (sometimes reduced to a small patch of orange hairs) and on this account are referred to *R. s. casensis* from Chance Island (without direct comparison of specimens). The single specimen from Koh Pra Tung is identical with those from Koh Rah. Measurements of ten specimens (except where stated): head and body 169–206 (189), tail 180–222 (193), condylobasal length 39.5–42.6 (40.9) (nine skulls) and maxillary toothrow 6.6–7.4 (7.1).

**Rattus surifer puket Chasen**

Junk Seylon, off west coast Peninsular Siam: ♂ ♂ 55.2537–2539, ♀ 55.2540 Telok Pales, ♂ ♂ 55.2541–2545, ♀ ♀ 55.2546–2550 Klong Tun Sui, Tongka.

Pulau Sireh, near Junk Seylon, off west coast Peninsular Siam: ♂ ♂ 55.2551–2552.

Koh Boi, near Junk Seylon, off west coast Peninsular Siam: ♂ ♂ 55.2553–2555, ♀ 55.2556.

Pulau Panjang, near Junk Seylon, off west coast Peninsular Siam: ♂ ♂ 55.2557–2563, ♀ ♀ 55.2564–2569.

Pulau Lontar, off west coast Peninsular Siam: ♂ ♂ 55.2570–2573, ♀ ♀ 55.2574–2577, ♂ 55.2578 (skin only), ♀ 55.2579 (skin only) Pasir Raja.

Specimens from Junk Seylon and its adjacent islets are very similar in colour to *R. s. surifer* from the adjacent mainland but are much smaller and on this account Chasen (1940) referred the *surifer* rats from these islands to *R. s. puket*, the type locality of which is Junk Seylon, the largest island.

Those from Junk Seylon are exactly like *R. s. surifer* from Ghirbi and Trang in colour and have comparatively little dorsal flecking. The dorsal and flank ground colour is a bright ochraceous brown and the fine flecking of black forms an ill-defined stripe along the median dorsal line. Ventrally, they are white or cream white, and there is no trace of an orange gorget. Two specimens from Pulau Sireh agree exactly with them in colour.

Specimens from Koh Poi and Pulau Lontar are slightly darker dorsally and have the black flecking coarser and more intensified, much as in the specimens listed here as *casensis*. The dorsal and flank ground colour tends to be a slightly brighter ochraceous than that of *R. s. surifer*. Ventrally, they exactly resemble those from Junk Seylon.

Dorsally, specimens from Pulau Panjang average darker than those from the other islands and are very similar in this respect to *casensis*, but have the dorsal and flank ground colour ochreous buff (much as in *R. s. surifer*), coarsely flecked with black. Ventrally, they are exactly like *surifer* and have no orange gorget. Specimens from all the islands have harsh, spinous dorsal pelage like that of *R. s. surifer*.

The differences between the populations of the respective islands are very small and of no subspecific significance, but do show, however, that the *surifer* rats of the large island of Junk Seylon have diverged least from the pattern of colour of the mainland form while those from the smaller islands of Lontar and Panjang have begun divergence towards the darker back characteristic of the rats of the smaller offshore islands further north. Measurements of specimens from each island:

*Junk Seylon* (thirteen specimens except where stated): head and body 145–180 (159), tail 148–195 (169), condylobasal length 36.8–40.2 (38.7) (twelve skulls), and maxillary toothrow 6.2–6.8 (6.6).

*Pulau Sireh* (two specimens): head and body 162–172, tail 178–188, condylobasal length 38.5–39.9 and maxillary toothrow 6.3–6.8.

*Koh Boi* (four specimens except where stated): head and body 160–172 (167), tail 155–173 (167), condylobasal length 38.1–40.1 (39.3) (three skulls), and maxillary toothrow 6.4–6.7 (6.5).

*Pulau Panjang* (twelve specimens): head and body 150–175 (160), tail 150–203 (169), condylobasal length 37.1–40.7 (38.6) and maxillary toothrow 6.2–6.9 (6.7).

*Pulau Lontar* (nine skins and seven skulls): head and body 151–183 (162) tail 161–186 (172), condylobasal length 36.2–40.0 (37.4) and maxillary toothrow 6.0–6.9 (6.6).

#### *Rattus surifer telibon* Chasen

Pulau Telibon, off west coast Peninsular Siam: ♂♂ 55.2590–2596, ♀♀ 55.2597–2599.

Dorsally, these specimens are darker and are more coarsely streaked with black than those listed above as *R. s. puket*. They average only very little darker above, however, than specimens from Pulau Panjang (here referred to *puket*) which themselves are the darkest representatives of *Rattus surifer* from Junk Seylon and the complex of small islands surrounding it. *Rattus surifer telibon* may also be distinguished from *puket* by its larger size, which is nearer to that of the mainland form and from the latter by its darker dorsal pelage. Ventrally, they exactly resemble *surifer* and *puket* and there is no orange gorget. The dorsal pelage is harsh and spinous as in these races. Measurements of eight specimens (except where stated): head and body 159–188 (172), tail 175–188 (181) (seven skins), condylobasal length 38.0–41.4 (39.3) and maxillary toothrow 6.9–7.3 (7.1). Chasen says that *telibon* never has the tail shorter than the head and body and while this is true of this series one specimen (55.2592) has the tail equal in length to the head and body. In the long series of *puket* listed above the tail is generally longer than the head and body, but in a number of specimens the tail is the same length or only slightly longer than the head and body, and in two specimens is shorter.

#### *Rattus surifer flavidulus* (Miller)

Pulau Langkawi, off Perlis: ♂♂ 55.2605–2606, ♀♀ 55.2607–2610 Sungai Kilim. ♂ 55.2611, ♀ 55.2612 Kuala Kubong Badak. ♂♂ 55.2613–2615, ♀♀

55.2616-2618, ♂ 55.2619 (skin only) Buraw. ♂ 55.2620 (skin only), ♂ ♂ 55.2621-2624, ♀ ♀ 55.2625-2628, ♂ 55.2629 (skull only).

These specimens (and others in the collection of the British Museum (Natural History) agree closely with Miller's description and show that when compared with *surifer* from the adjacent mainland, *flavidulus* from Langkawi averages darker dorsally, has the back more coarsely streaked with black and the dorsal and flank ground colour more yellowish. The race is somewhat smaller than that from the mainland and in this series the majority have the tail shorter than the head and body, only a few specimens having these equal in length while a single specimen has the tail of greater length than the head and body. Measurements: head and body 160-195 (180) (thirty-three skins), tail 140-190 (163) (thirty-two skins), condylobasal length 38.0-42.8 (39.9) (twenty-seven skulls) and maxillary toothrow 6.4-7.3 (6.8) (twenty-nine skulls).

#### *Rattus surifer butangensis* (Miller)

Pulau Adang, Butang Islands: ♂ ♂ 55.2600-2602, ♀ 55.2604.

Pulau Rawi, Butang Islands: ♀ 55.2603.

This small series agrees accurately with the description by Miller. The upper parts and flanks are less bright than those of *R. s. surifer* or *R. s. flavidulus* and are darker than in those races, the black element in the pelage being more coarsely spread and diffused, covering the entire back and showing no tendency to concentrate in the median line. One example, 55.2604 has the ground colour deep orange rather than the ochraceous buff of the others. Ventrally, these specimens are cream buff, unevenly blotched with ochreous orange. Measurements of four skins and three skulls; head and body 194-209 (200), tail 164-175 (171), condylobasal length 42.2-43.2 (42.7) and maxillary toothrow 7.0-7.4 (7.2). The tail is shorter than the head and body in all the specimens examined.

#### *Rattus surifer surifer* × *butangensis*

Pulau Terutau, off west coast Peninsular Siam: ♂ 55.2640, ♀ ♀ 55.2641-2643 Sungai Udang. ♂ 55.2644 Telok Udang. ♂ 55.2630 (skin only), ♂ ♂ 55.2631-2635, ♀ ♀ 55.2636-2639.

Chasen (1940) referred *surifer* rats from Terutau to *flavidulus*. This series, however, differs from the Langkawi race in a number of points and cannot be regarded as *flavidulus*. Specimens from Terutau have the ground colour of the back and flanks less bright than that of *flavidulus* or of *surifer* and as a series are darker, having the black element in the pelage more pronounced and more diffused over the back, nearer to but not quite as dark as *butangensis*. Ventrally, they are cream white, a few having the belly soiled with ochraceous or ochreous orange much as in *butangensis*, but less so than in this race. In all but two specimens the tail is sub-equal to the head and body. They are similar in size to *R. s. surifer* of the adjacent mainland, but have a longer toothrow and a shorter tail, and differ markedly from *flavidulus* in their greater size. Measurements: head and body 170-210 (189) (twenty-six skins), tail 160-190 (177) (twenty-live skins), condylobasal length 38.3-42.9 (40.8) (nineteen skulls) and maxillary toothrow 6.9-7.9 (7.3) (twenty-four skulls).

These specimens clearly represent a step in the line of divergence from *R. s. surifer* shown by *R. s. butangensis* towards dull, dark dorsal pelage, which is harsh and spinous, reduced tail and greater body size. It may be that they require subspecific separation from both forms but in the absence of a larger series of *butangensis* for comparison I am reluctant to take this step.

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***Rattus surifer surifer* × *flavidulus***

Pulau Dayang Bunting, near Pulau Langkawi, off west coast Peninsular Siam: ♂ ♂ 55.2645-2647, ♀ ♀ 55.2648-2650.

Chasen (1940) referred *surifer* rats from the islet of Dayang Bunting to *flavidulus* but this material is considerably larger than the Langkawi race and also has the ground colour of the back and flanks brighter and much more orange. In this respect, these specimens approach *surifer* of the mainland, from which they differ in having the black element of the dorsal pelage more pronounced and gathered into an ill-defined median streak as has *flavidulus*, in slightly larger body size, and shorter tail, which is usually subequal to the head and body (one specimen only has the tail greater in length than the head and body). Measurements of five specimens: head and body 186-203 (192), tail 172-193 (182), condylobasal length 40.2-43.4 (42.1) and maxillary toothrow 6.8-7.0 (6.9).

This rat shows to some extent the characters indicating the divergence of the *surifer* rats of the Butang Islands and Pulau Langkawi from the mainland *R. s. surifer*. The body size is greater and the tail reduced as in *butangensis* and although the dorsal ground colour is much as in the mainland form the black speckling is coarser and more pronounced as in *flavidulus*.

***Rattus surifer muntia* Chasen**

Koh Muk (Pulau Muntia), off west coast Peninsular Siam: ♂ ♂ 55.2651-2653, ♀ ♀ 55.2654-2655, ♀ 55.2656 (skull only), ♀ 55.2657 (skin only). Melanistic specimens: ♂ ♂ 55.2658-2663, ♀ ♀ 55.2664-2665.

In normal pelage, these specimens are darker dorsally than *flavidulus* as understood here, and have the black element in the dorsal pelage scattered over the entire back as has *butangensis* and *surifer* × *butangensis* from Pulau Terutau, which latter they closely resemble in colour, but dorsally are slightly darker. The ground colour of the back and flanks is pale ochraceous orange or ochraceous buff and the dorsal and flank pelage is plentifully supplied with harsh spines. They are much duller than the mainland *surifer* and lack entirely the bright orange tints of this race. Ventrally, *muntia* is a dirty cream buff, sometimes with a suffusion of yellow or orange (a condition found in material from Terutau and to a greater extent in *butangensis*).

The series is remarkable for the high proportion of melanistic specimens it contains. The collection of the British Museum (Natural History) now contains extensive series of *Rattus surifer* and presents no evidence of melanism in any other race of this rat. Melanistic specimens are dark brown (near to Prout's Brown of Ridgeway) dorsally, darkest and most intense in the median dorsal line. Ventrally, they vary from drab to dark grey. The dorsal underfur is dark grey, the hairs with dark brown tips. The dorsal pelage is thickly interspersed with harsh, grey, brown tipped spines. The flanks are lighter in colour and are profusely spinous, the spines light brown or whitish. The ventral surface is less spinous, while the limbs are dark brown above and below. There is a small, irregular cream patch in the ventral midline of some specimens. *Rattus surifer muntia* averages smaller than *butangensis* and is about the same size as specimens from Pulau Terutau. The tail, however, is longer in proportion to the head and body and is usually only a little shorter than the head and body. Measurements: head and body 174-202 (188) (fourteen skins), tail 169-200 (180) (thirteen skins), condylobasal length 38.9-43.7 (40.9) (twelve skulls) and maxillary toothrow 6.9-7.5 (7.1) (thirteen skulls).

*Rattus surifer pidonis* Chasen

Koh Pipidon, off west coast Peninsular Siam; ♂ ♂ 55.2666-2675.

*Rattus surifer pidonis* differs from *R. s. muntia* in darker, more uniform dorsal colour, the pelage less coarsely streaked with black and tending towards a brownish hue. An orange gorget is present in all the specimens listed here. There is no indication of the ochreaceous orange staining of the cream white belly found in *muntia*. *Rattus surifer pidonis* is larger than *R. s. muntia* but like this race, has the tail equal to or slightly shorter than the head and body. It is larger and dorsally darker than *surifer* from the adjacent mainland. Measurements: head and body 183-208 (198) (nine skulls), tail 178-196 (186) (eight skulls), condylobasal length 39.3-43.0 (41.0) and maxillary toothrow 6.7-7.2 (6.9) (nine skulls in both cases).

*Rattus surifer binominatus* (Kloss)

Pulau Tioman, Pahang Archipelago: ♂ ♂ 55.2700-2707; ♂ ♂ 55.2708 (skin only), 55.2712 (skull only), ♀ ♀ 55.2709-2711.

The *surifer* rats of the Johore Archipelago show similar differences from the mainland race as do the rats of the *rattus* group from those islands, i.e. darkening of the back and an increase in the length of the dorsal pelage. A corresponding similarity is found among the rat populations of these species from the small islands off the west coast of Peninsular Siam. Each island produces its own characteristic *rattus* and *surifer* rat, often diverging from the mainland race in similar ways and often exhibiting about the same degree of divergence. Populations from individual islands often differ from each other only slightly and forms can be found (usually from the inshore islands) which link the most divergent races (usually from the islands most distant offshore) to the mainland race in slight but quite distinct steps. The *surifer* rats of the Johore Archipelago are no exception to these general statements. Although the three named races are very similar to each other, *R. s. binominatus* is the least differentiated from the mainland race. Dorsally, these specimens are slightly darker than *R. s. surifer* and have the ground colour averaging more tawny and slightly less bright. The back is coarsely streaked with black, sometimes forming an ill-defined median streak. The dorsal pelage, although spiny, is longer and softer than that of the mainland form, especially over the rump. The ventral surface is cream white, often stained to some extent by yellow or tawny. A buff or orange gorget is usually, but not always, present. Measurements of seven specimens (except where stated): head and body 183-208 (195), tail 155-193 (180) (six skins), condylobasal length 41.3-44.1 (42.5) and maxillary toothrow 6.7-7.1 (6.9). 55.2702 is one of the original series.

*Rattus surifer aoris* (Robinson)

Pulau Aor, Johore Archipelago: ♂ ♂ 55.2676-2679.

These specimens are part of the original series. Dorsally, *R. s. aoris* is very slightly darker and duller than *pemangillis* or *binominatus*, and has the black element in the pelage more uniformly distributed with no tendency to gather into a median line. The dorsal pelage, while plentifully supplied with spines, is longer and softer than that of the other races from the Johore Archipelago. The cream white ventral surface is stained with buff or orange brown, as in *pemangillis*, to which this race is closely allied. Its longer, darker dorsal pelage makes it much less like *surifer* of the mainland than *R. s. binominatus* from the nearby larger island of Tioman. Measurements of four specimens (except where stated): head and body 193-210 (202), tail 184-191 (187) (three skins), condylobasal

length 40.5–44.5 (43.1), maxillary toothrow 7.0–7.5 (7.2), length of molar row (crowns) 6.3–6.7 (6.5), width of  $m^1$  2.0–2.2 (2.1) and width of  $m^3$  1.5–1.7 (1.7).

**Rattus surifer pemangilis** (Robinson)

Pulau Pemanggil, Johore Archipelago: ♂ ♂ 55.2680–2684, ♂ 55.2685 (skin only), ♀ ♀ 55.2686–2690.

Dorsally, these specimens do not differ appreciably in colour from *R. s. binominatus* but the dorsal pelage, although longer than that of *R. s. surifer* from the mainland, is harsher and contains more spines than that of the Tioman race. No specimen has a dull or orange gorget. The underparts, like those of *binominatus*, are frequently suffused with buff or ochraceous orange, sometimes (55.2685) to the extent of replacing almost entirely the cream white. These specimens form part of the original series. The race differs from *binominatus* in its proportionately larger body and shorter tail, and in having the underparts more stained with orange. Its skull is about the same size as that of the Tioman race and the molars (said by Robinson not to be reduced as in *binominatus*) are about the same size. Measurements: head and body 192–224 (209), tail 148–179 (164) (seven skins in both instances), condylobasal length 40.5–44.3 (42.0) (five skulls), maxillary toothrow 6.8–7.3 (7.1) (six skulls), length of molar row (crowns) 6.2–6.6 (6.4), width  $m^1$  2.0–2.1 (2.1) and width of  $m^3$  1.4–1.6 (1.5) (six skulls in each instance). Tooth measurements of *binominatus*: length of molar row (crowns) 6.0–6.6 (6.3), width of  $m^1$  1.9–2.1 (2.0) and width of  $m^3$  1.3–1.7 (1.5) (seven skulls in each instance).

**Rattus surifer manicalis** (Robinson and Kloss)

Koh Pennan, off Bandon, Peninsular Siam: ♂ ♂ 55.2691–2692, ♀ ♀ 55.2693–2694.

Part of the original series. Dorsally, much duller and darker than *R. s. surifer* with harsher and more spinous pelage, but retaining to some extent the bright ochraceous orange tints on head and flanks of the mainland race. All have the upper surface of the forearms whitish and the underparts cream white. Measurements of four specimens (except where stated): head and body 170–180 (176), tail 172–187 (178) (three skins), condylobasal length 37.5–39.2 (38.5) and maxillary toothrow 6.5–6.6 (6.6).

**Rattus surifer spurcus** (Robinson and Kloss)

Koh Samui, off Bandon, Peninsular Siam: ♂ ♂ 55.2695–2698, ♀ 55.2699.

Although diverging from the mainland *R. s. surifer* in the same direction as *R. s. manicalis* these specimens (which are from the original series) are less differentiated from the mainland race than is *manicalis*. They closely resemble *flavidulus* from Pulau Langkawi. *Rattus surifer spurcus* has the dorsal surface darker and more coarsely streaked with black, especially in the mid-line, than has *R. s. surifer* but the head and flanks are bright ochraceous orange as in the mainland race. Dorsally, *R. s. spurcus* is much brighter than *manicalis* and has softer pelage. It differs sharply from this race in its bright orange yellow dorsal and flank ground colour, which extends on to the head. The upper parts of the forearm are whitish as in *manicalis*. These rats are intermediate between *surifer* of the mainland and the much duller, darker *manicalis* from the island of Koh Pennan, in a similar fashion to *flavidulus*, which on the opposite side of the Peninsula links *surifer* to the dull, dark *butangensis*. Measurements of five specimens (except where stated): head and body 165–192 (178), tail 170–193 (182), condylobasal length 37.6–38.3 (37.9) (three skulls) and maxillary toothrow 6.2–6.9 (6.6).

**Rattus surifer flavigrandis (Kloss)**

East Perhentian Island, off Kelantan, Malay Peninsula; ♀ ♀ 55.2747-2748.

Two of the original series. They are much darker than *surifer* of the mainland and have the entire back uniformly and finely flecked with black or dark brown, showing no tendency to form a median line. Flanks and cheeks ochraceous, paler than in the mainland race. Underparts dirty white, in 55.2748 tinged with ochraceous, and with a trace of an orange gorget. Measurements of 55.2748 (F.M.S. 2221/10) appear in Kloss (1911).

**Rattus surifer grandis (Kloss)**

Great Redang Island, off Trengganu, Malay Peninsula; ♂ ♂ 55.2744-2745, ♀ 55.2746.

Part of the original series. These specimens are darker and duller than *flavigrandis* and the adult specimen (55.2744) has the dorsal pelage harsher and more spinous. Measurements of this specimen (F.M.S. 2207/10) appear in Kloss (1911).

**Rattus surifer leonis (Robinson and Kloss)**

Singapore Island: ♂ ♂ 55.2749-2751, ♀ ♀ 55.2752-2754 Changi.

Robinson and Kloss compared *leonis* with *R. s. surifer* from Trang in Peninsular Siam. These specimens are only very slightly brighter than material from the southern Malay States (as noted above, *R. s. surifer* averages brighter in the southern parts of its range than in the northern) but are easily separated from the mainland form on account of their smaller size. Measurements of seven skins and ten skulls: head and body 161-192 (177), tail 153-185 (176), condylobasal length 37.1-41.8 (39.6) and maxillary tooth-row 6.2-6.8 (6.6).

**Rattus surifer lingensis (Miller)**

Pulau Mapor, Riau Archipelago: ♂ ♂ 55.2740-2742 Mentiigi, ♂ ♂ 55.2713-2723, ♀ ♀ 55.2724-2738, 55.2739.

Pulau Kundur, Riau Archipelago: ♂ 55.2743 Blink.

The collection of the British Museum (Natural History) contains a large series of rats of the *surifer* group from the islands of Batam, Bintang, Kundur, Karimon, Little Karimon and Mapor, Riau Archipelago. All show to a greater or lesser degree the duller, darker back which distinguishes this race from *R. s. surifer* but populations from each island differ appreciably from each other, although the differences can hardly be said to be of subspecific value. No topotypical specimens are available.

Specimens from Pulau Kundur are nearest to *R. s. surifer* and retain the bright ochraceous orange dorsal and flank ground colour of the mainland form. The back, however, is heavily grizzled with black or dark brown, especially in the median line. Ventrally, they are white with usually a well-defined orange gorget. In general, they are reminiscent of *R. s. binominatus* from Tioman Island and differ from *surifer* of the mainland in darker, tawnier dorsal colour, greater body size and proportionately shorter tail.

Material from Batam and Bintang is very similar but generally has the dorsal and flank ground colour paler and more yellow, lacking in most examples the slight tawny infusion found in specimens from Kundur. The orange gorget is much reduced and is usually represented by a small patch of orange hairs at the throat. A long series from Pulau Mapor closely resembles that from Batam and Bintang but occasional specimens are tawny like those from Kundur and the majority have the dorsal black flecking slightly reduced when compared with specimens from Kundur, Batam or Bintang. The

orange gorget is usually reduced or represented by a few orange yellow hairs. Specimens from the islands of Karimon and Little Karimon have the dorsal ground colour paler and the back more heavily blackish, especially in the median line, than those from the other islands. They lack to a large extent the ochraceous orange tints found in this material and replace it with pale yellow or buff. An orange gorget, or traces of it, is only rarely present. Measurements:

*Pulau Kundur* (seven specimens): head and body 199–219 (207), tail 160–189 (179), condylobasal length 42.6–48.4 (45.5) and maxillary toothrow 6.8–7.6 (7.3).

*Pulau Batam*: head and body 183–211 (201), tail 157–191 (171) (nine skins in both instances), condylobasal length 43.2–44.6 (43.7) (six skulls) and maxillary toothrow 6.8–7.1 (7.0) (seven skulls).

*Pulau Bintang* (three specimens): head and body 191–217 (207), tail 158–181 (170), condylobasal length 41.4–45.1 (43.6); and maxillary toothrow 6.8–7.4 (7.1).

*Pulau Mapor* (eleven skins and ten skulls): head and body 182–207 (194), tail 152–191 (167), condylobasal length 40.3–43.2 (41.5) and maxillary toothrow 6.4–7.0 (6.7).

*Pulau Karimon* (four skins and six skulls): head and body 181–199 (191), tail 150–166 (158), condylobasal length 40.8–42.7 (41.8) and maxillary toothrow 6.5–6.9 (6.7).

*Little Karimon Island* (eight skins and six skulls): head and body 181–209 (193), tail 149–183 (173) condylobasal length 40.7–44.7 (43.3) and maxillary toothrow 6.6–7.2 (6.9).

Specimens from the Karimons and Mapor most nearly resemble the mainland *R. s. surifer* in size while those from Kundur, Bintang and Batam are most like *R. s. leonis* from Singapore colour. None approach the small size and bright colour of *R. s. leonis* from Singapore Island. Similar tendencies exist in the distribution of *Rattus rattus* (*q.v.*) over the Archipelago but in this species, divergence, although following similar lines, has proceeded further and resulted in subspeciation.

#### *Rattus cremoriventer* *cremoriventer* (Miller)

Peninsular Siam: ♀ 55.2821 Tasan, Chumpawn, 220 ft. ♂ 55.2822 Chong, Trang. ♀ 55.2836 Kao Luong, Nakon Sri Tamarat, 2,000 ft.

Kedah: ♀ 55.2830 Kedah Peak, 3,000 ft.

Perak: ♀ 55.2824 Gunong Kerbau, 5,000 ft. ♂ 55.2825 Maxwell's Hill, Taiping, 3,600 ft. ♀ 55.2826 Gunong Semanggul. ♀ 55.2827–2829 Gunong Ijau, 4,500 ft.

Dindings: ♀ 55.2831 Tanjong Hanlu.

Pahang: ♂ 55.2832 Genting, Kuala Lipis. ♂ 55.2833 Lubok Tamang. ♀ 55.2834 Gunong Sinyum, 1,595 ft.

Penang Island: ♂ 55.2839, ♀ 55.2840–2841 Telok Bahang.

Pulau Terutau, off west coast Peninsular Siam: ♀ 55.2835 Telok Wau.

Pulau Langkawi, off Perlis: ♂ 55.2837, ♀ 55.2838 Buraw.

Hitherto, the species appears to have been unrecorded from Penang Island. A specimen from Tasan, Chumpawn shows that this race extends at least as far north as the limits of the area checklisted by Ellerman and Morrison-Scott (1951). There is no consistent colour variation over the range as represented by this series. Specimens from

Langkawi and Terutau are slightly less bright in dorsal colour than those from the mainland but the difference is very small. Measurements of twenty skins and eighteen skulls (except where stated): head and body 121–162 (138), tail 172–216 (190) (nineteen skins), condylobasal length 30.1–34.4 (31.9) (fifteen skulls), palatal length 16.0–18.5 (17.0), zygomatic width 15.4–17.1 (16.0) (fourteen skulls), braincase width 13.9–15.3 (14.4) (fifteen skulls), maxillary toothrow 5.7–6.5 (6.0), interorbital breadth 5.5–6.3 (5.9), length of nasals 11.2–13.7 (12.2) and breadth of nasals 3.7–4.4 (4.0).

#### *Rattus cremoriventer kina* (Bonhote)

Sarawak: ♂ 55.949 Ulu Paku, Sarebas, ♂ 55.950, ♀ 55.957 Sungai Pelandok, Paku, Sarebas, ♂ 55.951 (skin only) Anyut, Paku, Sarebas, ♀ 55.953 Long Lenin, Tinjar River, ♂ 55.954, ♀ 55.955 Gunong Sidong, Samarahan, ♂ 55.956 Entawa, Samarahan.

This race is only separable from *R. c. cremoriventer* with difficulty and a larger series may prove it synonymous with the Peninsular form. These specimens do not differ materially in colour from *R. c. cremoriventer*. The principal diagnostic character used by Bonhote for the Bornean race was greater skull size but this is not maintained in the few specimens available. The nasals, however, average longer and broader in the six skulls of *kina* examined while the bodily size and tail length are appreciably less. Measurements of seven skins and six skulls: head and body 110–133 (120), tail 145–205 (173), condylobasal length 30.2–32.6 (30.9), palatal length 16.4–17.8 (16.9), zygomatic width 15.1–15.9 (15.5), braincase width 13.7–14.3 (13.9), maxillary toothrow 6.0–6.3 (6.2), interorbital breadth 5.8–6.1 (5.9), length of nasals 11.7–14.1 (12.7) and width of nasals 3.9–4.5 (4.3).

#### *Rattus fulvescens orbus* (Robinson and Kloss)

Peninsular Siam: ♂ ♂ 55.2815–2816, ♀ ♀ 55.2817–2819 Khao Luong, Nakon Sri Tamarat, 5,000–5,800 ft., ♂ 55.2820 Kao Nong, Bandon, 3,050 ft.  
55.2820 is one of the original series.

#### *Rattus fulvescens lepturus* (Jentink)

West Java: ♂ 54.180 (skin and mandible only), ♂ ♂ 54.181–183, 54.185–188, 54.184 (skin only), 54.189 (skull only), ♀ ♀ 54.190–198 Kandang Badak, Mount Gedeh, 7,900 ft., ♂ 54.199, ♀ ♀ 54.200–201, ♀ 54.202 (skin only) Tjibodas, 5,000 ft.

East Java: ♂ 54.203–204 Sodong Jerok, Idjen Massif, near Banjowangi, 3,900 ft.  
A detailed account of the very much larger series of which the West Javan material listed here once formed a part appears in Robinson (1917). The two examples from Sodong Jerok exactly resemble those from West Java.

#### *Rattus niviventer bukit* (Bonhote)

Peninsular Siam: ♀ 55.2898 Khoa Ram, ♂ 55.2899 Chong, Trung, ♂ ♂ 55.2900–2901, ♀ 55.2902 Tap-li (Klong Wan), Pakchan, ♂ ♂ 55.2903–2904 Nongkok, Ghirbi, ♂ 55.2905 Tang Pran, Tahuatang.

Perlis: ♂ 55.2906 Pelarit.

Perak: ♂ 55.2907 Temengoh, ♂ 55.2908 Krian Road, Taiping.

#### *Rattus niviventer pan* (Robinson and Kloss)

Koh Samui, off Bandon, Peninsular Siam: ♂ 55.2909.

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### **Rattus niviventer condorensis Kloss**

Pulau Condore, off south-east Cochin China: ♀ 49.428 (the type specimen).

### **Rattus niviventer treubi Robinson and Kloss**

1919 *Rattus bukit treubi* Robinson and Kloss, Ann. Mag. Nat. Hist. 4: 476. Tjibodas, Mount Gedeh, West Java, 5,000 ft.

1931 *Rattus lepturus besuki* Sody, Natur. Tijdschr. Ned.-Ind. 41: 214. Ongop Ongop, Idjen Massif, East Java, 1,850 m.

1934 *Rattus bukit lepturoides* Sody, Natur. Tijdschr. Ned.-Ind. 44: 174. Mount Lawu, Middle Java, 2,000 m.

East Java: ♂ ♂ 54.205-213, ♀ ♀ 54.214-219 Sodong Jerok, Idjen Massif, near Banjewangi, 3,900 ft.

West Java: ♂ ♂ 54.220-225 Tjibodas, 5,000 ft.

*Rattus niviventer* in Java has been divided into three races, two from the mountains of east and west Java respectively, and a third, *temminckii*, from the lowlands of east Java. *Rattus bukit lepturoides* Sody is regarded as a synonym of *besuki* by Chasen (1940), and material now available indicates that only one race is found throughout the mountains of Java.

Sody originally described *besuki* as a race of *lepturus* (itself a race of *Rattus fulvescens*) and compared his two specimens from Ongop Ongop with *lepturus*, from which they differed in smaller size and in having the underside of the base of the tail a clearer white. A large series from Sodong Jerok, however, shows no constant difference from typical and paratypical *treubi* and offers no grounds upon which to divide *niviventer* in Java into eastern and western mountain races. Specimens from east and west Java are strictly comparable in both size and colour, and Sody's measurements for *besuki* fit well into the series. Measurements of thirteen specimens (except where stated) from Sodong Jerok: head and body 111-136 (126), tail 164-207 (185), condylobasal length 30.4-34.1 (32.0) (twelve skulls), palatal length 16.8-19.6 (17.9), zygomatic width 15.4-17.2 (16.1), interorbital breadth 5.3-6.1 (5.8), maxillary toothrow 6.2-6.6 (6.4), length of nasals 12.0-14.7 (13.0) (twelve skulls) and width of nasals 3.5-4.4 (3.8). Of six specimens from Tjibodas: head and body 130-149 (137), tail 178-186 (183), condylobasal length 30.5-33.4 (32.0), palatal length 16.8-18.5 (17.7), zygomatic width 15.5-16.6 (15.9), interorbital breadth 5.5-5.8 (5.6), maxillary toothrow 6.0-6.7 (6.3), length of nasals 12.2-14.1 (13.1) and width of nasals 3.7-4.1 (3.9).

### **Rattus bukit temminckii Kloss**

East Java: ♂ 54.226 Tamansari, 1,600 ft.

### **Rattus alticola ochraceiventer (Thomas)**

Sarawak: ♀ 55.990 Mount Dulit, Barum, 3,400 ft. ♀ 55.991 Sungai Lenin, Tinjar River, 500 ft. ♂ 55.992, ♀ 55.993 Gunong Sidong, Samarahan, 1,200 ft. ♀ 55.994 Bukut, Samarahan.

These five specimens agree fairly well with the limited comparative material available, all of which comes from Mount Kinabalu. Although considerable size discrepancy is evident over the series of skulls there appears to be only one form involved in Sarawak and North Borneo, these differences and small differences in the texture of the pelage being due to age. The type and a paratype with which Robinson's material has been compared are both fully adult animals with the teeth well worn while Robinson's specimens and others from Kinabalu with closer, denser pelage and shorter, slightly

narrower skulls with the muzzle narrower and less elongated are all animals with unworn or only slightly worn teeth. Measurements of five young adult skins from Sarawak; head and body 125–136 (129), tail 137–150 (142). Measurements of eleven skulls (except where stated), including the type: condylobasal length 29.9–36.4 (32.1) (nine skulls), palatal length 16.0–19.4 (17.1), rostral width 4.9–7.0 (5.7), braincase width 14.5–15.5 (15.0) (ten specimens), length of diastema 8.6–10.8 (9.3) and maxillary toothrow 5.3–5.7 (5.5).

#### **Rattus alticola inas** (Bonhote)

Pahang: ♂ ♂ 55.2800–2801, ♀ 55.2802 Bukit Fraser, above Seimangko Pass, 4,000 ft. ♂ ♂ 55.2803–2804, ♀ ♀ 55.2805–2806 Gunong Taban, 3,500–5,300 ft. ♀ ♀ 55.2807–2809 Teku Plateau, Gunong Taban, 5,200–5,300 ft.

Measurements of twenty-four skins and seventeen skulls; head and body 125–165 (143), tail 130–166 (147), condylobasal length 32.2–36.3 (34.2) and maxillary toothrow 6.0–6.6 (6.3).

#### **Rattus musschenbroecki whiteheadi** (Thomas)

Sarawak: ♂ ♂ 55.958–960 Bulingean, ♂ 59.961, ♀ 55.962 Mount Dulit, Baranti. ♂ 55.963 Anyut, Paku, Sarebas. ♀ 55.964 Gunong Sidong, Samarahan, ♂ ♂ 55.965–967, ♀ ♀ 55.968–969 Mora Barue, Samarahan. ♂ ♂ 55.970–971, ♀ 55.972 Entawa, Samarahan.

Chasen (1940) gives a summary of colour variation over the Malaysian range of this species. This series, dorsally, varies from dull ochraceous buff to bright russet brown, sometimes with a diffuse black median streak. Ventrally, the specimens range from clear grey to ochraceous orange.

#### **Rattus musschenbroecki asper** (Miller)

Peninsular Siam: ♀ 55.2777 Khao Ram.

Perlis: ♂ 55.2779 Pelarit.

Perak: ♀ 55.2778 Lenggong, ♀ 55.2780 Temengoh. ♂ 55.2781 Ulu Selama. ♂ 55.2788, ♀ 55.2789 Bukit Gantang. ♂ 55.2790 Gunong Semanggul.

Kedah: ♂ ♂ 55.2782–2784. ♀ ♀ 55.2785–2786 Kedah Peak. ♀ 55.2787 Gurun.

Pahang: ♀ 55.2791 Bentong. ♂ 55.2792. ♀ 55.2793 Labang Endau.

Selangor: ♀ 55.2794 Cheras. ♂ 55.2795 Gingting Bidai.

Malacca: ♀ 55.2798 Nyalias.

Negri Sembilan: ♂ 55.2796 Bukit Tangga. ♂ 55.2797 Bukit Tampin.

Johore: ♂ 55.2799 Padang Tuan, Segamat.

This series shows much the same range of colour variation as does *R. m. whiteheadi* from Borneo but *asper* is in general a duller backed rat, usually grey beneath and with the underside rarely washed with ochraceous or buff. Brightly coloured specimens are few, the majority having an admixture of grey or black hairs dorsally. A diffuse patch of orange is often found in the median line of the chest.

#### **Rattus bartelsi bartelsi** (Jentink)

West Java: ♂ ♂ 54.227–232, ♀ ♀ 54.233–236, ♀ 54.237 (skull only) Tjibodas, 5,000 ft.

A detailed account of the very much larger series of which these specimens once formed a part appears in Robinson (1917).

**Rattus bartelsi** subsp.

East Java: ♀ 54.238 Sodong Jerok, Idjen Massif, near Banjoewangi, 3,900 ft.

The pelage of this rat is harsher than that of *R. b. bartelsi*, notably in the mid-dorsal line. It differs from *bartelsi* in its coarser, paler orange flanks and its darker median dorsal streak. The underparts are cream white and not grey with a cream wash as in *bartelsi*. There is a collar of yellow buff hairs at the base of the throat not found in the series of *bartelsi* examined and the limbs are drab grey without the warm rufous tinge of *bartelsi*. It is rather larger than *bartelsi* from Tjibodas and considerably larger than published measurements of *obscurus* Bartels from Mount Slamet, the description of which it agrees with. Measurements: head and body 141, tail 146, greatest length of skull 37.4, condylobasal length 34.2, zygomatic width 17.1, maxillary toothrow 6.4 and diastema 10.0.

**Rattus edwardsi cilicatus** (Bonhote)

Pahang: ♂ 55.2922 Wray's Camp, Gunong Tahan, 3,000 ft. ♂ 55.2925 Bukit Fraser, above Sentangko Pass, 4,000 ft. ♂ 55.2926. ♀ 55.2927 Teku Plateau, 5,200-5,300 ft.

Selangor: 55.2923 Menang Gasing, Ulu Langat, 3,000 ft. ♀ 55.2924 Gunong Mengkuang Lebar, 4,800 ft.

**Rattus bowersi ferrenicanus** (Miller)

Perak: ♂ 55.2929 (skin only) Gunong Ijau, 4,700 ft.

Kedah: ♀ 55.2928 Gurun,

♀ 55.2928 is an immature specimen and like 20.7.3.57 from Maprit, Patiyu, also an immature specimen (see Kloss (1916)), is paler than the adult and has the dorsal pelage light brown.

**Rattus norvegicus norvegicus** (Erxleben)

Perak: ♂ 55.3148 Kuala Kurau.

Johore: ♀ 55.3151 Johore Bahru.

Singapore Island: 55.3149 Devonshire Road, Singapore. ♀ 55.3150.

**Rattus sp.**

Peninsular Siam: ♀ 55.3187 (skin only) Nongkok, Ghirbi.

Pahang: ♀ 55.3188 Cameron's Highlands.

Sarawak: ♂ 55.995, ♀ 55.996 Ulu Anyut, Paku, Sarawak. ♂ 55.997 Bukar, Samarahan. ♀ 55.998 Entawa, Samarahan.

**Chiropodomys gliroides gliroides** (Blyth)

Kedah: ♂ ♂ 55.3192-3194, ♀ 55.3195 Kedah Peak, 3,000 ft.

Pahang: ♀ ♀ 55.3190-3191 Teku Plateau, Gunong Tahan, 5,300 ft. ♂ 55.3198 Gunong Benom, 5,000 ft. ♂ 55.3199, ♀ ♀ 55.3200-3201 Semangko Pass.

Selangor: ♀ 55.3196 Bukit Kulu, 3,400 ft. ♀ 55.3197 Gunong Mengkuang Lebar, 1,900 ft.

There appears to be no difference of subspecific significance between this small series and *gliroides* from Burma and Assam. (Chasen (1940)) referred Peninsular material to *peguensis*, considered by Ellerman and Morrison-Scott (1951) a synonym of *C. g. gliroides*.

*Chiropodomys gliroides pictor* Thomas

Sarawak: ♂ 55.999, ♀ 55.1000 Bukar, Samarahan.  
 Ellerman and Morrison-Scott (1955) consider this form and that following to be  
 well-marked outliers of *C. gliroides*.

*Chiropodomys gliroides anna* Thomas and Wroughton

West Java: ♀ 54.245 Tjiomas, Pandeglang.

*Pithecheir melanurus parvus* Kloss

Selangor: ♂ 49.430 (the type specimen) Bukit Kutu, 3,400 ft.

*Rhizomys sumatrensis sumatrensis* (Raffles)

Perak: ♂ 55.3202 The Cottage, Larut Hills. ♀ 55.3203 Bukit Gantang, Larut.

*Hystrix brachyura brachyura* Linnaeus

Pahang: ♀ 55.3204 Kuala Tahan. ♂ 55.3205 (skull only) Sulah North.

*Atherurus macrourus macrourus* (Linnaeus)

Pahang: ♂ 55.3206 (skull only) Skeat's Camp, Gunong Tahan.

*Atherurus macrourus lionis* Thomas

Pulau Tioman, Pahang Archipelago: ♂ ♂ 55.3209-3210. ♀ 55.3211 Juara Bay.

*Atherurus macrourus zygomaticus* Miller

Pulau Aor, Johore Archipelago: ♂ ♂ 55.3207-3208.

*Atherurus macrourus pemanggilis* Robinson

Pulau Pemanggil, Johore Archipelago: ♀ 49.435 (the type specimen). ♀ 55.3212.

*Trichys lipura macrotis* Miller

Perak: ♂ 55.3213 Runuk Tanjong.

*Tragulus kanchil napu* (Cuvier)

Perak: ♀ 55.3215 Taiping.

Johore: ♀ 55.3214 Padang Tuan, Segamat.

*Tragulus kanchil rufulus* Miller

Pulau Tioman, Pahang Archipelago: ♂ 55.3216. ♀ ♀ 55.3217-3219 Juara Bay.

*Tragulus kanchil terutus* Thomas and Wroughton

Pulau Terutau, off west coast Peninsular Siam: ♂ ♂ 55.3220-3221 Sungai Udang.  
 ♂ 55.3222, ♀ ♀ 55.3223-3224 Telok Wau.

*Tragulus kanchil borneanus* Miller

Sarawak: ♂ 55.1009 (skin only), ♀ 55.1010 Sungai Pelandok, Paku, Sarebas. ♂  
 55.1011, ♀ ♀ 55.1012-1014 Paku, Sarebas.

*Tragulus javanicus angustiae* Kloss

Tepasserim: ♂ 55.3225 (the type specimen) Bankachon, Victoria Province.

Peninsular Siam: ♂ 55.3226 Tap-li (Klong Wan), Pakchan.

Gibson-Hill (1949) lists the type specimen as believed lost.

*Tragulus javanicus rarus* Miller

Peninsular Siam: ♂ 55.3227, ♀ 55.3228 Nongkok, Ghirbi. ♂ 55.3229 Chong, Trang. ♂ 55.3230 Lam-ra, Trang. ♀ 55.3231 Koh Lai, Raiburi. ♀ 55.3232 Ban Kok Klap, Bandon.  
 Kedah: ♂ 55.3233 Gurun.  
 Perlis: ♀ 55.3234 Pelarit.  
 Perak: ♂ 55.3235 Temengoh, ♂ 55.3236 Kuala Temengoh.  
 Selangor: ♂ 55.3237, ♀ 55.3238 Kuala Lumpur.

- *Tragulus javanicus fulviventer* Gray

Singapore Island: ♀ 55.3239 Changi.

- *Tragulus javanicus penangensis* Kloss

Penang Island: ♂ ♂ 55.3240-3241 Telok Bahang. ♀ 55.3242 Pantai Kirchut.

*Tragulus javanicus insularis* Chasen

Pulau Panjang, near Junk Seylon, off west coast Peninsular Siam: ♂ ♂ 55.3243-3244 Telok Poh.  
 Junk Seylon, off west coast Peninsular Siam: ♀ 55.3245, ♀ 55.3246 (skin only) Klong Tun Sai.

Pulau Sirih, near Junk Seylon, off west coast Peninsular Siam: ♀ 55.3247.

*Tragulus javanicus pidonis* Chasen

Koh Pipidon, off west coast Peninsular Siam: ♂ ♂ 55.3248-3249.

*Tragulus javanicus rarus* Miller

Pulau Adang, Butang Islands: ♂ 55.3250, ♀ 55.3251,  
 Pulau Rawi, Butang Island: ♂ 55.3252.

- *Tragulus javanicus lanceavensis* Miller

Pulau Langkawi, off Perlis: ♂ 55.3253, ♀ 55.3254 Buraw.

*Tragulus javanicus hosei* Bonhote

Sarawak: ♀ 55.1007 Entawa, Samarahan. ♂ 55.1008 Sungai Pelandok, Paku, Sarebas.

*Muntiacus muntjak peninsulae* Lydekker

Perlis: ♂ 55.3255 Pelarit.  
 Dindings: ♂ 55.3256 (skin only) Tanjung Hantu, Pahang: ♂ 55.3257 Kuala Tahan.

*Muntiacus muntjak annamensis* Kloss

South Annam: ♂ 55.3258, ♀ 55.3259 (the cotypical specimens) Langbian Peak.

*Muntiacus muntjak rubidus* Lyon

Sarawak: ♀ 55.1001 Anyut, Paku, Sarebas. ♂ 55.1002 Paku, Sarebas. ♂ 55.1003, ♀ 55.1004 Sungai Pelandok, Paku, Sarebas.

Chasen (1940) lists *Muntiacus muntjak* and *Muntiacus pletharicus* as separate species from Borneo, but considers the latter (which he had never seen) of doubtful validity.

More recently, Van Bemmelen (1952) treats *M. pleiharicus* as a race of *M. muntjak* having a wide area of overlap with *M. m. rubidus* in Sarawak. This treatment of the two forms, which appear from the available material to be quite distinct, has been adopted in the present paper.

The specimens listed above, together with four in the collection of the British Museum (Natural History), agree closely with the description of *M. m. rubidus*. There is no dark dorsal stripe and the frontal area between the antler pedicles is bright rufous, as is the back of the head. A conspicuous black line extends down the antler pedicles to a point over the eyes. In general, they may be distinguished from the specimens here referred to *M. m. pleiharicus* by their bright reddish brown colour, which contrasts sharply with the more yellowish appearance of the latter race.

***Muntiacus muntjak pleiharicus* (Kohlbrugge)**

Sarawak: ♂ 55.1005 Ulu Paku, Sarebas. ♂ 55.1006 Paku, Sarebas.

Apart from the original description, a detailed account of this form is given by Lyon (1911a). These specimens, together with five in the collection of the British Museum (Natural History), conform closely with this and with the original description. The brown median dorsal line is usually indistinct and in two specimens there is a strong infusion of rufous on the rump. In all the specimens examined, the frontal area is black, this colour extending over the nape and merging into the dark median dorsal line. There is little or no black on the yellowish or rufous antler pedicles. The general colour of the body and legs is yellowish, in contrast to the reddish brown body and dark brown legs of *M. m. rubidus*. Two skulls have short, spike-like antlers on slender pedicles and lacking burrs, like those described and figured by Lyon (1911a), while a third skull has antlers of a similar pattern but with a well-defined burr. Males of *M. m. rubidus* have antlers of normal pattern for the genus. The cranial characters listed by Lyon (1911a) for the two forms hold good for the series of skulls (mostly damaged) examined. The lachrymal pit in *pleiharicus* is deeper than in *rubidus* and the concavity at the posterior end of the nasals (in the lateral aspect) in *rubidus* is not present in *pleiharicus* in which this surface is flat or convex. Lower edge of the meso-pterygoid fossa is not rounded as in *rubidus* but sharply pointed.

The following Forms are described as new in this paper,

- Ratufa affinis klossi* subsp. nov. page 47.
- Callosciurus notatus raptor* subsp. nov. page 59.
- Callosciurus notatus tinggius* subsp. nov. page 61.
- Rattus rattus phurnus* subsp. nov. page 75.
- Rattus rattus sribuataensis* subsp. nov. page 76.
- Rattus rattus kabanicus* subsp. nov. page 77.
- Rattus rattus terutavensis* subsp. nov. page 79.

## References

- BANKS, E. 1930. Interbreeding among some Bornean Leaf-Monkeys of the Genus *Pithecius*. *Proc. zool. Soc. Lond.* 693-695 (1929).
- 1931. The forms of Prevost's Squirrel found in Sarawak. *Proc. zool. Soc. Lond.* 1335-1348, map.
- BONHOLE, J. L. 1903. Report on the Mammals. *Fasciculi Malayenses, Zoology*, 1: 1-45, pls. 1-4.
- CHASEN, F. N. 1933. Notes on Bornean Mammals. *Bull. Raffles Mus.* 8: 195-198.
- 1933a. On the forms of *Rattus rattus* occurring on the mainland of the Malay Peninsula. *Bull. Raffles Mus.* 8: 5-24.
- 1935. On mammals from Siam. *J. Siam Soc. nat. Hist. Suppl.* 10: 31-57.
- 1937. On insular *Rattus rattus* from the North-west coast of the Malay Peninsula. *Bull. Raffles Mus.* 13: 81-93.
- 1940. A Handlist of Malaysian Mammals. *Bull. Raffles Mus.* 15: i-xx, 1-209, map.
- CHASEN, F. N. and C. B. KLOSS. 1929. Notes on Flying Lemurs (*Galeopterus*). *Bull. Raffles Mus.* 2: 12-21.
- 1931. On a collection of Mammals from the Lowlands and Islands of North Borneo. *Bull. Raffles Mus.* 6: 1-82.
- 1931a. On "rattus" rats of the coasts and islands of Malacca Straits. *Bull. Raffles Mus.* 5: 76-79.
- DAMMERMAN, K. W. 1931. The Mammals of Java. I. Rodentia (Leporidae, Hystricidae, Sciuridae). *Treubia*, 13: 429-470, figs. 1-8.
- 1938. On Jalorensis-Rats and other Mammals from the Krakatau Islands. *Treubia*, 16: 421-443, 3 figs.
- DICE, H. H. and H. J. LERAAS. 1936. A graphic method of comparing several sets of measurements. *Contributions Lab. Vert. Genetics*, No. 3: 1-3.
- ELLERMAN, J. R. 1947. A key to the Rodentia inhabiting India, Ceylon and Burma, based on collections in the British Museum. *J. Mammal.* 28: 249-278 (Part I), 357-387 (Part II).
- 1949. Families and Genera of living Rodents. Vol. III, part I. London: British Museum (Natural History).
- ELLERMAN, J. R. and T. C. S. MORRISON-SCOTT. 1951. Checklist of Palaearctic and Indian Mammals, 1758-1946. London: British Museum (Natural History).
- 1955. Supplement to Chasen (1940). A Handlist of Malaysian Mammals. London: British Museum (Natural History).
- GIBSON-HILL, C. A. 1949. Bird and Mammal Type Specimens formerly in the Raffles Museum Collections. *Bull. Raffles Mus.* 19: 133-198.

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- HARRISON, J. L. 1957. Habitat of some Malayan Rats. *Proc. zool. Soc. Lond.* 128: 1-21. ROB
- HUBBS, C. L. and A. PERLMUTTER. 1942. Biometric comparisons of several samples, with particular reference to racial investigations. *Amer. Nat.* 76: 582-592, 1 fig. tabs. 1-3.
- INGOLDBY, C. M. 1927. Some notes on the African Squirrels of the Genus *Heliocciurus*. *Proc. zool. Soc. Lond.* 471-487, pls. 1-4.
- KLOSS, C. B. 1911. On a collection of Mammals and other Vertebrates from the Trengganu Archipelago. *J. Fed. Mal. St. Mus.* 4: 174-212. RON
- 1916. On a collection of Mammals from Siam. *J. Nat. Hist. Soc. Siam.* 2: 1-32.
- 1918. On a fourth collection of Siamese Mammals. *J. Nat. Hist. Soc. Siam.* 2: 49-69.
- 1921. Seven New Malaysian Mammals. *J. Fed. Mal. St. Mus.* 10: 299-234.
- 1921a. Some rats and mice of the Malay Archipelago. *Treubia*, 2: 115-124.
- 1929. Some remarks on the Gibbons, with the description of a new subspecies. *Proc. zool. Soc. Lond.* 113-127.
- 1932. Notes on the Malayan races of *Ratufa affinis* (Raffles). *Bull. Raffles Mus.* 7: 1-2.
- LYON, M. W. 1911. Descriptions of four new Treeshrews. *Proc. Biol. Soc. Wash.* 24: 167-170. SHA
- 1911a. Mammals collected by Dr. W. L. Abbott on Borneo and some of the small adjacent islands. *Proc. U.S. Nat. Mus.* 40: 53-146, pls. 1-7.
- 1913. Treeshrews: an account of the Mammalian Family Tupaiidae. *Proc. U.S. Nat. Mus.* 45: 1-188, pls. 1-11. SOD
- MAYR, E., E. G. LINSLEY, and R. L. USINGER. 1953. Methods and principles of Systematic Zoology. New York: McGraw Hill Publishing Company.
- MILLER, G. S. 1942. Zoological Results of the George Vanderbilt Sumatran Expedition, 1936-1939. Part V.—Mammals collected by Frederick A. Utner, Jr. on Sumatra and Nias. *Proc. Acad. Sci. Phil.* 94: 107-165, pls. 3-6.
- POCOCK, R. I. 1927. The Gibbons of the Genus *Hylobates*. *Proc. zool. Soc. Lond.* 719-741, text figs. 19-23.
- 1934. The Geographical Races of *Paradoxurus* and *Paguma* found to the East of the Bay of Bengal. *Proc. zool. Soc. Lond.* 613-683, pls. 1-2, figs. 1-11.
- 1935. The Monkeys of the Genera *Pithecius* (or *Presbytis*) and *Pygathrix* found to the East of the Bay of Bengal. *Proc. zool. Soc. Lond.* 895-961, pls. 1-2, figs. 1-5, (1934). TAB
- POOLE, A. J. and V. S. SCHANTZ. 1942. Catalog of the Type Specimens in the United States National Museum, including the Biological Surveys Collection. *U.S. Nat. Mus. Bull.* 178: i-xiii, 1-705. TAB

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- ROBINSON, H. C. 1916. On an aberration of *Sciurus prevosti prevosti* from South western Pahang. *J. Fed. Mal. St. Mus.* 7: 19-21.
- 1916a. A note on the variation of a local race of *Epimys rutilus*, *Epimys rutilus jarak* (Bonhote) from Pulau Jarak, Straits of Malacca. *J. Fed. Mal. St. Mus.* 7: 9-18.
- 1917. On two little known rats from Western Java. *J. Fed. Mal. St. Mus.* 7: 93-99.
- 1921. Two new Indo-Malayan Rats. *Ann. Mag. nat. Hist.* 7: 234-236.
- ROBINSON, H. C. and C. B. KLOSS. 1915. On a collection of Mammals from the Siamese Province of Bandon, N.E. Malay Peninsula. *J. Fed. Mal. St. Mus.* 5: 111-127.
- 1916. The Zoology of Koh Samui and Koh Pennan. *J. Fed. Mal. St. Mus.* 5: 130-139.
- 1918. Notes on the Genus *Petaurista*, Pall., with descriptions of two new races. *J. Fed. Mal. St. Mus.* 7: 223-226.
- 1918a. A nominal list of the Sciuridae of the Oriental Region with a list of the specimens in the collection of the Zoological Survey of India. *Rec. Ind. Mus.* 25: 171-254.
- 1918b. Results of an Expedition to Korinchi Peak, Sumatra. Mammals. *J. Fed. Mal. St. Mus.* 7: 1-80.
- 1919. On mammals, chiefly from the Ophir District, West Sumatra, collected by Mr. Jacobson. *J. Fed. Mal. St. Mus.* 7: 299-323.
- SHAMEL, H. H. 1930. Mammals collected on the island of Koh Tau off the east coast of the Malay Peninsula. *J. Mammal.* 11: 71-74.
- SODY, H. J. V. 1928. Over *Callosciurus notatus* (Bodd.) met beschrijving van 2 nieuwe subspecies. *Natuurk. Tijdschr. Ned.-Ind.* 88: 325-332.
- 1929. Namlijst van der zoogdieren van Java met korte beschrijvringen van twee nieuwe subspecies (*Callosciurus*, *Rattus*). *Natuurk. Tijdschr. Ned.-Ind.* 89: 160-166.
- 1933. On the Mammals of Bali (with a note on the races of *Callosciurus notatus* of Java). *Natuurk. Tijdschr. Ned.-Ind.* 83: 56-95.
- 1941. On a collection of rats from the Indo-Malayan and Indo-Australian Regions. *Treubia*, 18: 255-325.
- 1949. On a collection of Sciuridae from the Indo-Malayan and Indo-Australian Regions, with descriptions of 20 new species and subspecies, and with some remarks on the essential significance and the denomination of subspecies. *Treubia*, 20: 57-120.
- TATE, G. H. H. 1941. A review of the Genus *Hipposideros* with special reference to Indo-Australian species. *Bull. Amer. Mus. Nat. Hist.* 78: 352-393, figs. 1-5.
- THOMAS, O. 1892. Descriptions of two new Bornean Squirrels. *Ann. Mag. nat. Hist.* 10: 214-216.

- VAN BEMMEL, A. C. 1952. Contribution to the knowledge of the genera *Muntiacus* and *Arctogalidia* in the Indo-Australian Archipelago (Mammalia, Cervidae and Viverridae). *Beaufortia*, No. 16: 1-50, figs. 1-2.
- WROUGHTON, R. C. 1915. Bombay Natural History Society's Survey of India, Burma and Ceylon. No. 16. *J. Bomb. Nat. Hist. Soc.* 23: 460-480, No. 17, *ibid.* 23: 695-720.